# AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 10, No. 36 WEEKLY. | NEW YORK, SEPTEMBER 3, 1887. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.



COPYRIGHT 1887, BY AMERICAN MACHINIST PUBLISHING COMPANY. For Sale Everywhere by Newsdealers. ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

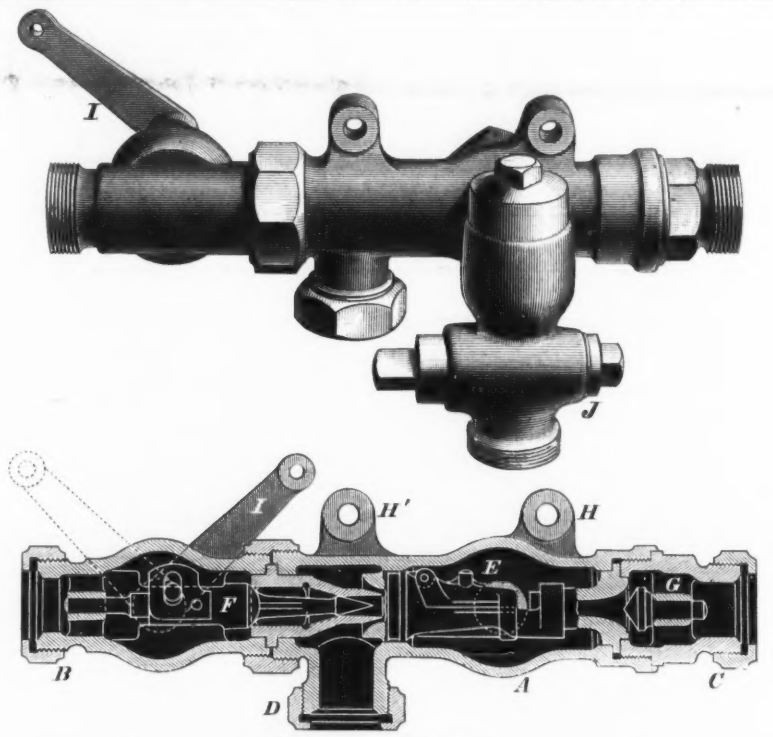

## New Automatic Re-Starting Injector.

We present with this engravings of an injector now being introduced in this country by Schaffer & Budenberg, 40 John street, New York. Although new here, this injector has already been put into quite extended use in Europe, especially on locomotives in Germany.

It is of the type known as "re-starting." Should this injector lose its water from any cause whatever, it will start working without touching the handle or being in any way interfered with by the attendant, as soon as there is any water it can get. Thus in use on a locomotive or traction engine, should it "jar off," it requires no attention whatever. Or at work in any place should the water supply temporarily cease, the injector will get to work as soon as water comes again. As a matter of experiment the suction pipe may be disconnected above the water when the injector is working, then coupled up again, and the injector will start working. It will lift water 26 feet, and it will feed against a pressure double that of the steam pressure; it can be throttled down to less than half its capacity without wasting water at the overflow. It will also continue to work under large variation in steam pressure. No valve is required in the suction pipe except where water is supplied under hydrant or other pressure; no manipulation is required in starting except moving a single lever.

The engravings represent this injector as used on locomotives. Referring to these the shell *A* has the usual number of openings, viz., steam inlet *B*, water inlet *D*, overflow *J* and feed *C* to boiler. The steam valve *F* has an elongation terminating in a cone for regulation. This valve is operated by handle *I*; the dotted position of handle represents extreme motion.

The nozzle *E* is of peculiar construction; instead of being solid, as is usual, it is divided through the center, and the upper part is hinged to the lower, as represented near *E*. This is the re-starting feature of the injector. When the injector loses its water this hinged part opens wide, the effect being the same as cutting the nozzle *E* through the center longitudinally and removing one half. Steam then passes out through the overflow. As soon as there is water for the injector to get, this quick over-flow out of the divided nozzle permits the injector to start at once without any gauging of the water or steam. Then the current is at once established, but very little water being wasted at the overflow, the flap falls into place, and the injector works exactly as if the nozzle were solid. In starting the injector this quick overflow also permits of the handle being thrown back at once, a very small amount of water being lost. Another good feature of this divided nozzle is that, opening completely, there is no stricture for the lodgment of dirt, which would stop the working of the injector.




RE-STARTING INJECTOR.

The check valve *G* serves the usual purpose. The overflow is at *J*; the overflow valve is a plain poppet. There is an opening on each side of the case for attaching the overflow; this permits the injector to be used for either right or left hand, the side not in use being covered with a cap. That part of case containing valve *F* can also be turned to the right or left, bringing the lever into the position most convenient.

A special lubricated plug cock, of excellent construction, provides for blowing steam into the tender.

The material is steam metal, and all parts are interchangeable, so as to be duplicated without delay.

## Valve for Gas Apparatus.

Trouble is experienced with ordinary valves for controlling the flow of air to the furnaces of gas-generating apparatus from the accumulation of fine carbon on the seats, this accumulation going on until serious leakage occurs. The valve illustrated herewith is designed to prevent this as far as possible, and to provide ready means to come at both valve and seat for cleaning when necessary. It has also other important features of construction, as will be seen.

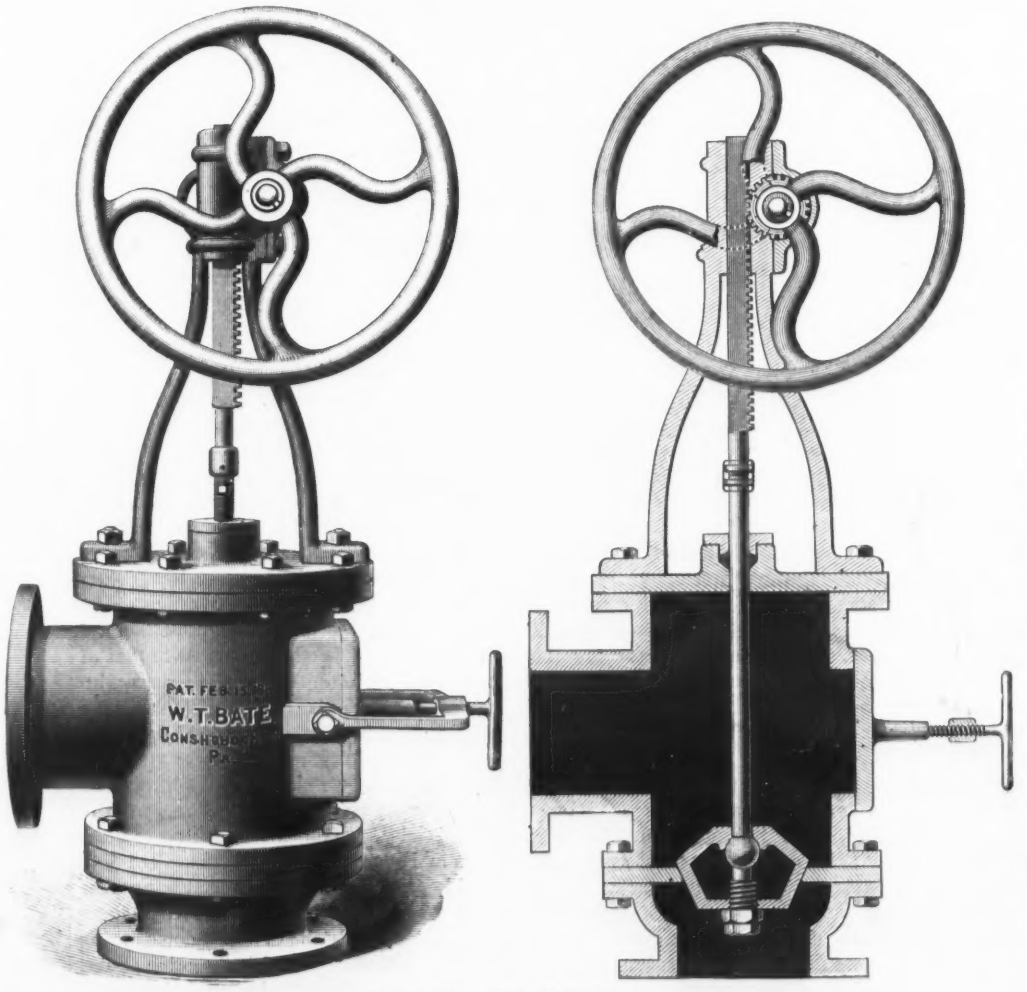
By referring to the sectional cut, it will be observed that the seat is conical in shape, the angle being sufficiently sharp to avoid the lodgment of carbon under all ordinary circumstances. The seat is made in a separate disk, which is secured between the flanges of the valve casing. This seat can, if it should be required, be readily removed for repairs.

The valve stem is arranged with a ball bearing, plainly represented in the engraving; this permits the valve to accommodate itself to slight irregularities in the seat. The door, or hand hole, shown in both views, provides ready access to the valve and seat, so that carbon that lodges on the level portion of the seat disk can be removed.

For convenience in removing the valve for cleaning or other purpose, the stem is made in sections, coupled together by means of a sleeve.

In order to prevent the accumulation of gas in the supply pipe below the valve, which might result from slight leakage, a small valve, not shown, is placed below the main valve. This small valve is spring-loaded, and so arranged as to be opened by the main valve when the latter is closed, and to be closed by the spring when the main valve is opened.

These valves are made by William T. Bate & Son, Conshohocken, Pa.




VALVE FOR GAS APPARATUS.

## Was it Spontaneous Combustion?

BY WILLIAM J. WILLIAMS.

About ten years ago I was engaged in a manufactory; among its products was a cement composed of plumbago, soapstone, whiting and linseed oil. In consistency it was about like putty that is used for glazing. The cement was made in a chaser; the two chaser rolls were of cast-iron, weighing 1,200 lbs. each, and revolved at the speed of seventy revolutions per minute. The bed was also of cast-iron. Time taken to make a batch, one hour. Previous to what I am going to relate, each batch, as it was finished, was put into a barrel, and, when full, was headed up and shipped, if it was for an order, or put in stock, as the case might be. I was always the first to arrive at the mill in the morning. On this morning, when I opened the door, the building was full of what may be called a thin blue smoke, of a kind that was anything but agreeable to smell or taste. The source of the trouble

seemed to be the cellar or basement, where there were several machines, among them the chaser for making the cement. There was also a kiln for drying certain kinds of stock, and a fire in the furnace. Naturally I supposed the trouble was at this point. On examination nothing was wrong there. On further investigation, the fire was found to be in a barrel of the cement; the contents of the bottom of the barrel had taken fire, burnt the bottom out, and also the bottom hoops (a wooden bound barrel), and a hole through the wooden floor on which it stood. About one-third of the contents of the barrel from bottom up was in a state of combustion; the rest was unchanged. There was no possible connection between the fire in the barrel and the fire in the kiln, for they were at least twenty feet apart. Every one connected with the establishment denied the possibility of such a composition taking fire, in face of the fact before them.

When each batch was taken out of the machine it had considerable heat in it, caused undoubtedly by the friction of chasers in the making. After this occurrence no more was put in barrels as it came from the machine, but laid on the floor until it had lost its heat. Now, at least two of the constituents are almost incombustible; the third, viz., whiting, is not a very fiery kind of material. Oil will burn, of course. Query: Why did it commence to burn at the bottom? In fact, why did it burn at all? To me the question is as unsettled now as it was ten years ago, when it happened, and what makes it more incomprehensible is, that this cement was made to resist fire.

Two very large belts are now making in Fall River, Mass. One is 4 feet wide, 103 feet long and made of three thicknesses of leather, cemented and riveted together. It required three weeks' labor and the hides of 75 cattle. The other belt is 3 feet wide, 237 feet long, and 100 hides are being used in its construction.

According to the *Telegram-Herald* of that city, the Portable House Company, of Grand Rapids, Mich., is now building a car load—eight cottages—for the use of army officers in Texas, also two car loads of cottages for California. The houses are pretty, and very conveniently arranged. The parts are shipped "knocked down," and the cottages cost all the way from $85 to $500. This would seem to be a good line of manufacture for other localities to engage in where timber is plenty. For summer resort purposes in this climate, as well as for living purposes all the year round in warm countries, such houses are available, and it ought to be possible to build up a large trade in them.

## Modern Locomotive Construction.

By J. G. A. Meyer.

FORTY-SECOND PAPER.

SLIDES, CONTINUED.

Sometimes the thickness of the slides is greater at the center of their length than at the ends, as shown in Fig. 241; this is done to reduce the weight of the slides; or, in other words, this form of slide is believed to give the maximum strength with the minimum amount of metal. To taper the slides adds considerably to the expense of labor, and since the extra weight of slides with parallel faces or straight slides is not objectionable, the writer believes that straight slides, such as shown in Fig. 260, and whose thickness or depth throughout is equal to the thickness at the center of tapered slides having the same work to do, are more desirable to use, and will give as good, if not better, results; again, observing that the majority of locomotives have straight slides, we are led to believe that many master mechanics and locomotive builders share our opinion.

In determining the depth of a slide for a crosshead requiring one slide only, as shown in Fig. 248, good judgment must be used, because in this case we must not only make the slide sufficiently strong to resist the thrust of the connecting rod, but we must also make it deep enough to guide the end of the piston rod in a straight line laterally. It should also be remembered, that since slides of this kind will wear on the upper and lower surfaces, we must allow double the amount for replaning that has been allowed in the other class of slides; that is to say, when only one slide is used for a crosshead, then we should allow for replaning $\frac{1}{4}$ of an inch on the upper sliding surface, and $\frac{1}{4}$ of an inch for the lower sliding surfaces. Taking these things into consideration we may employ for determining the depth or thickness of a slide, such as shown in Fig. 248, the following rule:

*Rule* 24. Find the depth of the slide by Rule 23, add the necessary amount for replaning, and increase this sum by 25 to 35 per cent., to obtain sufficient depth of slide to guide the piston rod in a straight line laterally.

*Remarks.*—When the crank is turning in the direction of arrow 1, Fig. 260, that is when the engine is running ahead, the weight of the crosshead has a tendency to reduce the thrust of the connecting rod against the upper slide; but when the engine is running in the direction of arrow 2, that is, running backward, the thrust of the connecting rod against the lower slide will be increased by the weight of the crosshead. But in locomotives the thickness of the upper slide is always equal to that of the lower one, and therefore in determining the thickness of either slide, the weight of the crosshead should be taken in account; and furthermore, to be very precise, a part of the weight of the slide should also enter our calculation. For the sake of simplicity, we omitted referring to these items in Rule 23, but they were taken into consideration when the constant number 1,200 was determined upon. Hence these rules should only be used for determining the thickness or depth of locomotive slides, or slides for engines of similar design.

*Cast-iron Slides.*—Sometimes locomotive slides are made of cast-iron. In Figs. 258 and 259 we have shown the form and given the dimensions of cast-iron slides, working satisfactorily in ten-wheeled engines having 19×24 inch cylinders.

*Slide Bolts.*—The slides are held in position at one end by the yoke brace *Y*, Fig. 260, and at the other end they are fastened to the cylinder head. The yoke brace is made strong enough to prevent the end of the slide moving in a vertical direction, but has not sufficient strength to resist a force acting against it in a horizontal direction, consequently it cannot resist the horizontal force due to the friction between the slides and crosshead. Therefore in designing the manner of holding the slides in position, only one bolt is used at the yoke end, and two bolts are used at the cylinder end. The bolt at the yoke end and one of the bolts at the cylinder end, we may say, are for the purpose of resisting the thrust of the connecting rod or forces due to it, and the second bolt at the cylinder end is for the purpose of resisting the force acting in a horizontal direction or pull due to friction between the slides and crosshead. These bolts are generally $\frac{3}{4}$ of an inch in diameter for small locomotives; $\frac{7}{8}$ and sometimes 1 inch in diameter for larger locomotives; and occasionally we meet with bolts $1\frac{1}{16}$ inch in diameter for locomotives having cylinders 20 inches in diameter. It is always best to use tapered bolts for this purpose, because these must have a good fit, and if they are made straight it would require too much labor, or the bolt may be ruined in driving it out, when that becomes necessary to take out the thin strips of copper placed between the slide blocks and slides to take

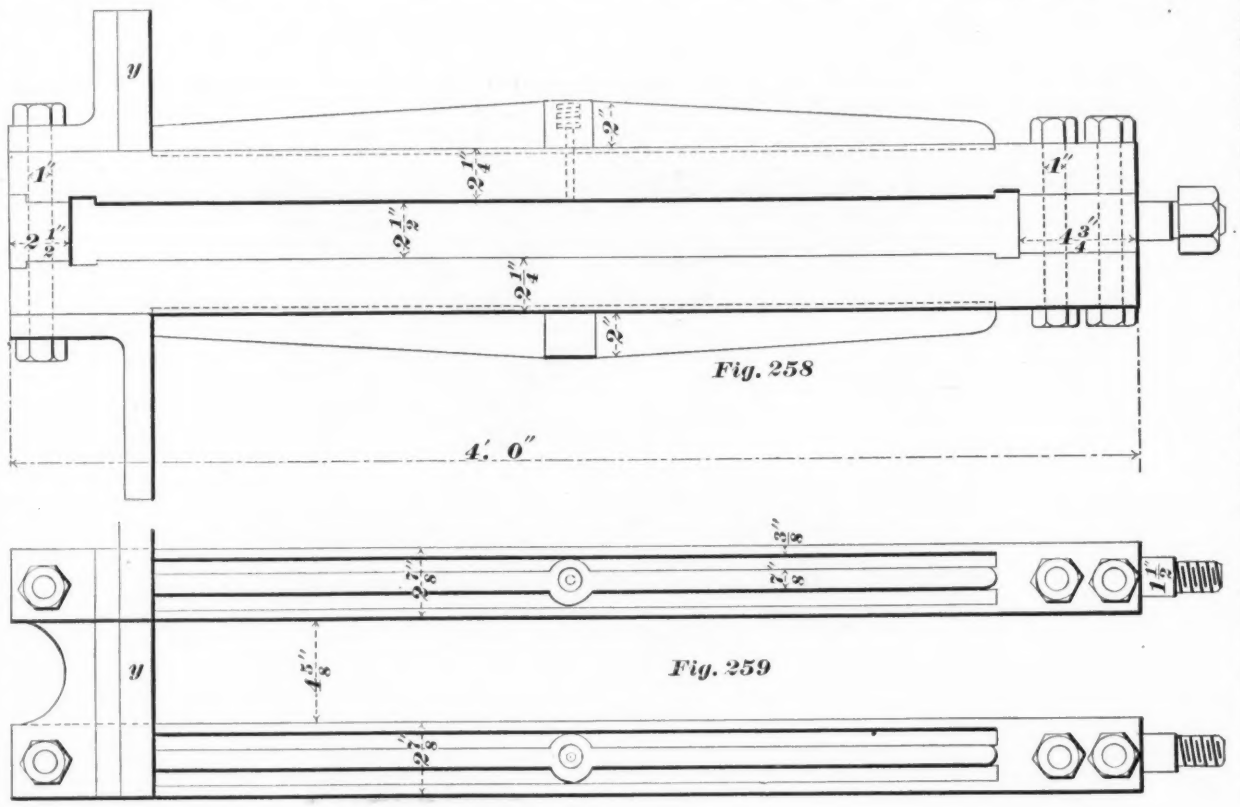



Fig. 258

Fig. 259

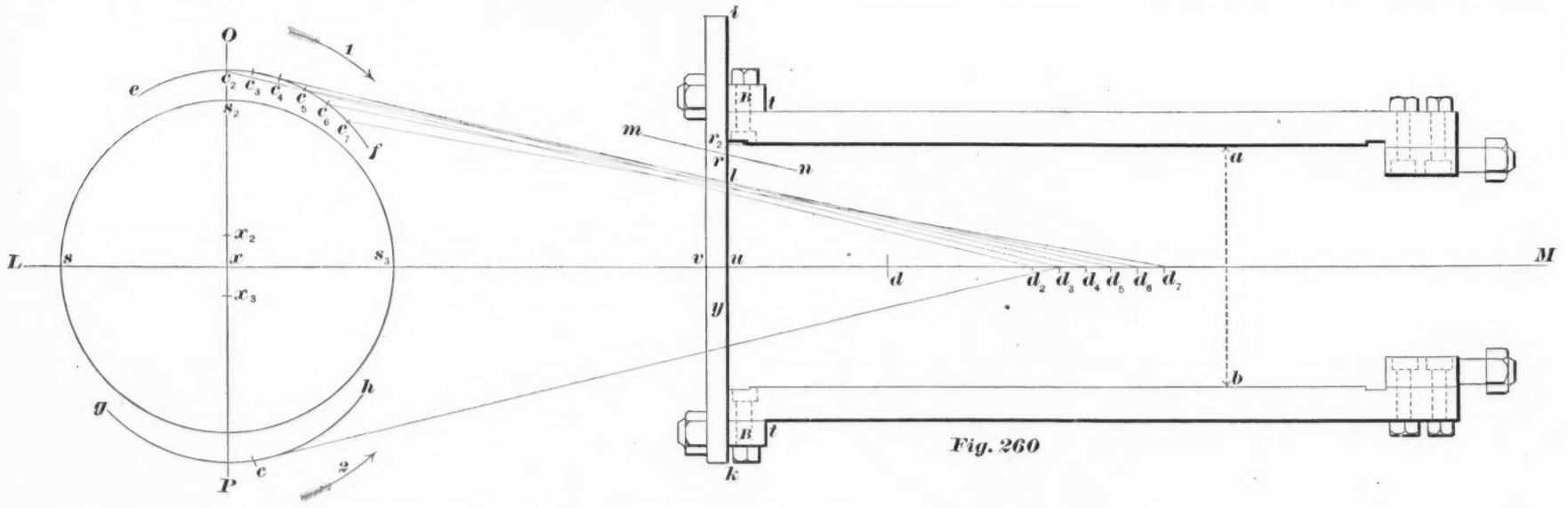



Fig. 260

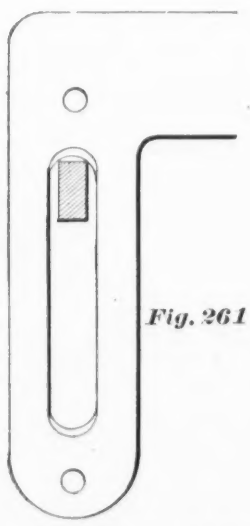


Fig. 261

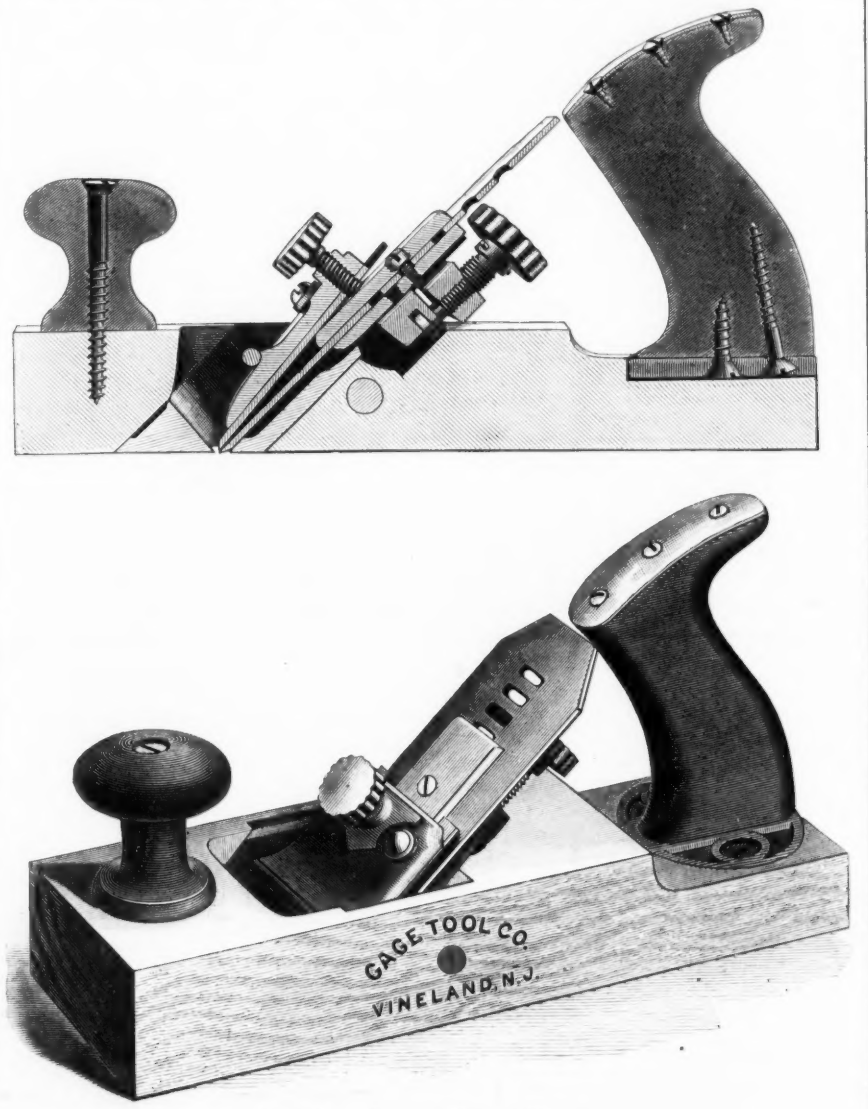
up the wear. It should also be noticed that in locomotives having cylinders of the same diameters but different design of crosshead, the diameters of the slide bolts in the design shown in Figs. 234 and 237 are about the same as the diameters of the slide bolts used in the design shown in Fig. 260; yet when we compare the manner of fastening the slides at the yoke end in these designs, it would seem that in the designs Fig. 234 and 237 slide bolts of smaller diameter can be used than in the design shown in Fig. 260; because in the former two designs some of the thrust of the connecting rod acts directly against the bolts; whereas in the latter design the same amount of thrust seems to act directly against the slide blocks *B B*. But a closer examination of the design in Fig. 260 will make it apparent that, should the slides spring, which may occur, and often does occur, then the thrust will act with a long leverage against the bolt having but a very short leverage—the edge of the slide block being the fulcrum—and thus greatly increase the stress in the bolt at the yoke end. For these reasons, then, we may assume that the amount of stress of the slide bolts in design Fig. 260 is the same as the amount of stress of the slide bolts in designs Fig. 234 and 237 when the thrust of the connecting rod in one case is equal to that in the other case.

*Distance Between the Slides.*—The distance from *a* to *b* between the slides in Fig. 260—this distance also determines the width of the crosshead—must be sufficiently great to clear the connecting rod in any oblique position which it may occupy during one revolution of the crank. Our first step then will be to find the position of the yoke brace *y*, when the length of the connecting rod, stroke, and length of crosshead is given; and secondly, we must find that oblique position of the connecting rod which will require the greatest distance between the slides. Let *L M* (Fig. 260) represent the center line of motion and the point *x* on this line the center of the axle. From the point *x* as a center, and with a radius equal to half the stroke, describe a circle $s\ s_2\ s_3$; the circumference of this circle will represent the path of the center of the crank pin when the center of the axle is at *x*. From the point *s*, at which the circumference cuts the line *L M*, lay off on the center line of motion *L M* a point *d*, the distance between the points *s* and *d* must be equal to the length of the connecting rod. From the point *d* towards *s* lay off a point *u*, the distance between the points *d* and *u*, measured on the line *L M*, must be equal to the sum of the clearance at the rear end, and the horizontal distance between the center of crosshead pin and the rear end of the sliding surface of the crosshead, or the rear end of the gib when one is used; also on the line *L M* lay off from the point *u* towards *s* a point *v*; the distance between the points *u* and *v* must be equal to the thickness of the yoke brace. Through the points *u* and *v* draw straight lines perpendicular to the center line of motion; these lines will represent the inner and outer faces of the yoke braces, and thus establish its position. This position of the yoke brace is the closest towards the cylinder head which it can occupy; sometimes the yoke brace may have to be moved towards the center of axle in order to clear the driving wheel or to suit other parts of the design. Secondly, to find the oblique position of the connecting rod which will require the greatest distance between the slides. Through the point *x* draw a straight line *O P* perpendicular to *L M*; on this line *O P* lay off above the center *x* a point $x_2$, the distance between the points *x* and $x_2$ must be equal to the distance through which the driving box can move before it strikes the frame, hence, the point $x_2$ will be the center of the axle when the driving box occupies its highest position in the pedestal of the frame. Again, on the line *O P* lay off below the center *x* a point $x_3$ the distance between the points *x* and $x_3$ must be equal to the distance through which the driving box can move before it strikes the pedestal cap, hence, the point $x_3$ will be the center of the axle when the driving box occupies its lowest position in the pedestal. From the point $x_2$ as a center and with the radius equal to half the stroke describe an arc *e f*; also from the point $x_3$ as a center and with the same radius describe an arc *g h*. When the driving box is in its extreme highest position the arc *e f* will be the path of the center of crank pin; and when the driving box is in its extreme lowest position, the arc *g h* will be the path of the center of crank pin. From the point $c_2$ at which the line *O P* cuts the arc *e f* lay off on this arc a number of points $c_3, c_4, c_5, c_6, c_7$; the distance between these points should be about two inches or a little less. From these points as centers and with a radius equal to the length of the connecting rod describe a number of short arcs cutting the center line of motion *L M* at the points $d_3, d_4, d_5, d_6, d_7$. Join by straight lines the points $c_3$ and $d_3$, $c_4$ and $d_4$, $c_5$ and $d_5$, etc., then the line $c_3\ d_3$ will represent the center line of the connecting rod when the crank pin is at $c_3$, and the lines $c_4\ d_4$, $c_5\ d_5$, etc., will represent the center line of connecting rod when the crank pin is at $c_4\ c_5$, etc. Now select that center line of the connecting rod which cuts the inner face *i k* of the yoke brace at a point furthest away from the line *L M*. In our illustration the line $c_5\ d_5$ cuts the line *i k* at the point *l*, and there is not another line representing the center line of connecting rod which will cut the line *i k* at a point beyond the point *l*, hence the line $c_5\ d_5$ will represent the center line of the connecting in such an oblique position which will require the greatest distance between the upper slide and the line *L M*, and consequently the upper slide must be placed high enough to clear the connecting rod when it occupies this position. Above the center line $c_5\ d_5$ draw a line *m n* to represent the upper edge of the connecting rod; the space between the line $c_5\ d_5$ and the line *m n* must be equal to that between the center line of connecting rod and its outer edge at a corresponding distance from either end of the rod; if the edges of the rod are parallel to each other then of course the line *m n* will also be parallel to $c_5\ d_5$; if the rod is tapered then the line *m n* must have the same inclination to $c_5\ d_5$ as the edges of the rod have to its center line.

The line *m n* cuts the line *i k* at the point *r*, and theoretically the distance between the points *u* and *r* would be the required distance between the center line of motion *L M* and the lower face of the upper slide. But since small inaccuracies in workmanship are very difficult to avoid, we must allow some extra space for these inaccuracies, and besides this the ends of the slot in the yoke, shown in Fig. 261, are usually semi-circular, and the face of the slide is placed even with the ends of the slot, or, in other words, tangent to the curved part, and therefore some allowance in the distance between the slides must be made to enable the edges of the rod to clear the curved surface in the slot of the yoke. Therefore, above the point *r* lay off on the line *i k* a point $r_2$; the distance between the points *r* and $r_2$ must be equal to a clearance considered to be sufficient to allow for the inaccuracy of workmanship and the semi-circular form of the end of the slot. In the case before us let the distance between the points *r* and $r_2$ be equal to $\frac{1}{2}$ of an inch. Through the point $r_2$ draw a horizontal line $r_2\ a$, which will be the lower surface of the upper slide, and thus the position of the upper slide is established. The position of the lower slide is found in precisely a similar manner, and thereby the distance between the slides determined. It should be remarked here that, because frequently the distance between the centers *x* and $x_2$ is greater than the distance between the centers *x* and $x_3$, the distance between the center line *L M* and the upper slide will be greater than that between the line *L M* and the lower slide; therefore, after the position of the upper slide has been determined and the centers $x_2$ and $x_3$ are not equidistant from the center *x*, then the positon of the lower slide must be determined in a manner similar to that adopted for determining the position of the upper slide.

If, on the other hand, the centers $x_2$ and $x_3$ are equidistant from the center *x*, then the position of only one of the slides is found in a manner similar to that here given, and the remaining slide is placed at a distance from the center line of motion *L M* equal to that between *L M* and the slide whose position has been found by construction.

The construction in Fig. 260 shows plainly that the distance between the slides does not simply depend upon the angle formed by the center line of motion *L M* and the center line of connecting rod, but that the distance depends upon this angle, and also upon the position of the yoke brace. Consequently, drawing the connecting rod in a position so that its center line will be tangent to the path of the crank-pin, as shown by the line $c\ d_3$ (Fig. 260, and then making the distance between slides to clear only this oblique position of connecting rod, as is often done, may result in bringing the slides too close together, and lead to considerable trouble, annoyance and waste of labor in having to chip the ends of the slides, and to increase the length of slot in yoke brace.




NEW SELF-SETTING BENCH PLANE

## New Self-Setting Bench-Plane.

The illustrations represent a new self-acting bench-plane which has been perfected and is now manufactured and introduced by the Gage Tool Company of Vineland, N. J. This tool combines the advantages of the iron and the wood plane, and is claimed to possess points of superiority over many excellent planes already on the market. The construction of this plane is clearly shown in the sectional view, and, as will be seen, is very simple. In replacing the bit, no setting of the same is required, as it falls with great accuracy into the correct position, and in this respect the plane is self-setting. For minute accuracy the bit is adjusted by the screw shown behind the cutter, and after it has been properly adjusted it cannot be set wrong or moved out of position by striking a knot while in the act of planing, which is a feature to be appreciated by all who have occasion to use a plane. The cap is not attached to the cutter, but remains stationary, and is clamped into position by the screw passing through it. The cutter can be moved up or down by the thumb-screw shown behind the bit, and thus, even while at work, the thickness of a shaving can be changed by a simple movement of the thumb and finger. Provisions have also been made by which the bit or cutter can be set square with the face of the plane, even if the cutter is not ground exactly square with itself. The throat is prevented from wear by being within the adjustable iron bit-holder, which extends through the plane. It is claimed, and this claim is based upon actual trial, that the cap and cutter can be removed, and accurately readjusted in five seconds, consequently the time saved in setting the bit would alone amount to many days' labor in the course of a year usually spent in setting the cutter. The Gage Tool Company pride themselves in their selection of the steel for and the tempering of the cutters, by which they obtain a uniform cutting quality, enabling the company to warrant their planes for planing the hardest hemlock knot to the satisfaction of the users.

It is also claimed that the tool can be changed from a double to a single iron, or from a single to a double iron, in two seconds. It can be adjusted to the coarsest or finest work, and will smooth cross-grained, eaty, hard or soft wood, against the grain. The plane stocks are saturated with hot wax or oil.

Old-fashioned wood-planes can readily be changed to this new plane.

The following from the *Evening Sun* is pertinent: "Why is it that the wages of the boiler makers in the navy yard are reduced? Is this great Government, with an income of a million a day, not able to pay as much for such service as private employers cheerfully give?"

The exhibition of the Middlesex Mechanics Association will be held in Lowell, Mass., beginning October 4. While this is intended to be a local exhibition, it is understood that exhibits from outside will be admitted.

## Need of Special Tools for Making Standard Machinery.

By W. H. HOFFMAN.

SECOND PAPER.

It has been the aim of our iron makers in this country, not only to rival each other in quality, but also in variety of grades for special purposes. There is no place where better pig-iron is made than in America, and the designer and constructor has ready at hand the materials for great strength, as well as rapid machine cutting. The superintending engineer of any standard machine works, after deciding on the consistency of the metals to be used, can instruct the foundry foreman as to the grades of iron needed to conform to the requirements, while the foreman can regulate the daily "heats" with a view to the highest economy in stock and labor.

Any foundry capable of melting two tons and upwards per day, should have a good testing machine, fitted for tensile and transverse specimens, and strong enough for pieces of one square inch of section, and two square inches in transverse testing, the latter pieces to be from one to three feet long; and thus equipped the foreman should make tests daily, keeping detailed records of the same. Fifteen hundred dollars invested in a first-class testing machine will, in a foundry making a hundred tons of castings per month, pay for itself in about a year, by the saving in material and labor on rejected castings returned from the machine shop; for if the foundryman is sure of his mixture, and reasonably sure of his workman, he will be quite sure that his product will "pass muster" at the hands of the master mechanic in the machine shop.

The general superintendent of modern practice, finding the foundry product reliable, can safely plan his machine shop methods accordingly. He knows that the cutting capacity of his tools can be increased to the safe working point of the steel, which is never reached on castings of irregular grade, and he therefore designs his machine, and the machine tool to cut it, with a view to the greatest economy in the machine department. If he is building a machine that requires the use of V tracks, or guides, he does not put this work into the hands of the machine shop foreman without first instructing him to select from among his machine tools (should he have no special milling machine) a planer with a strong crosshead, and a long table, and then to devise a method similar to the sketch shown, to cut them truly and rapidly by the continuous system. The second driving pinion on any stiff planer can be shipped out of gear, while a strong set of bearings can be fastened to the crosshead, to carry the tool or cutter arbor, which will be driven from one end by a set of cut gearing and cone pulleys. As the first pinion shaft is easy to remove, a new one can be substituted which will extend far enough beyond the bearing to put on a worm-wheel, the worm being so arranged as to be lifted out of gear while the table is returning after finishing a set of racks. The cutters can be raised and lowered by the regular crosshead screws, at will.

The sketch accompanying this paper is made to illustrate, in a general way, the different methods of applying the rapid cutting system to our ordinary machine shop tools.

If a new plant of tools is to be purchased, or if there is to be a steady business in the cutting of such pieces, then, of course, there should be a special machine built for this work.

Except for some few varieties of work the small planing machine is anything but an economical tool, and if a machine shop has many of them it will pay the owners to change some of them to special milling machines, as the cost of such a change is very moderate compared with the cost of new heavy milling machines of like capacity. A 22″×22″×6 foot planer can be fitted with a first-class milling attachment for less than two hundred dollars, and this machine will be much more rigid in the bed, table, sideposts, and crosshead, than the average milling machine, and the spindle can be so firmly carried that there is no possible chance for springing or chattering when heavy feeds and cuts are used, and such an attachment for key-seating shafting, etc., is a valuable one.

But it is not the intention of the writer to give detailed descriptions of the various ways of changing our present stan lard machine tools to the continuous cutting system, although the planer, the lathe, and the horizontal and vertical drilling machines can always be easily pressed into such service with a light expenditure in tool making.

As stated in my first paper, the designer should, after accomplishing the required movements of any machine to be made in large quantities, so arrange every detail that it can be finished in the machine shop by the revolving cutter if it is possible to do so. Then, again, he should design the machine so that but few special tools will be required to build it, making each special machine do at least two special cuts if possible, though it does not pay to try to get too much work out of one special tool, as this course will be attended with a loss of time.

In adopting rotary cutting, the machines, chucks, centers, and arbors, must be ample in strength and fitted in the best manner. The cutters should be of the very best quality of tool steel, as cheap material means a loss of time in the tool room and machine shop. The rotary cutting machine must be convenient for receiving and handling the work to be done, and in placing and removing the cutters, while the feeds must be strong and perfect in every respect. If the machine is open on one side, like the ordinary milling machine, the cutter head, post, and reach-arm must be very heavy and stiff in design, otherwise the cutting power of the machine is very much reduced.

We saw this practically illustrated quite recently on a new milling machine fresh from the makers, as the coarse feeds and rapid cuts could not be used on account of the excessive springing of the parts just mentioned.

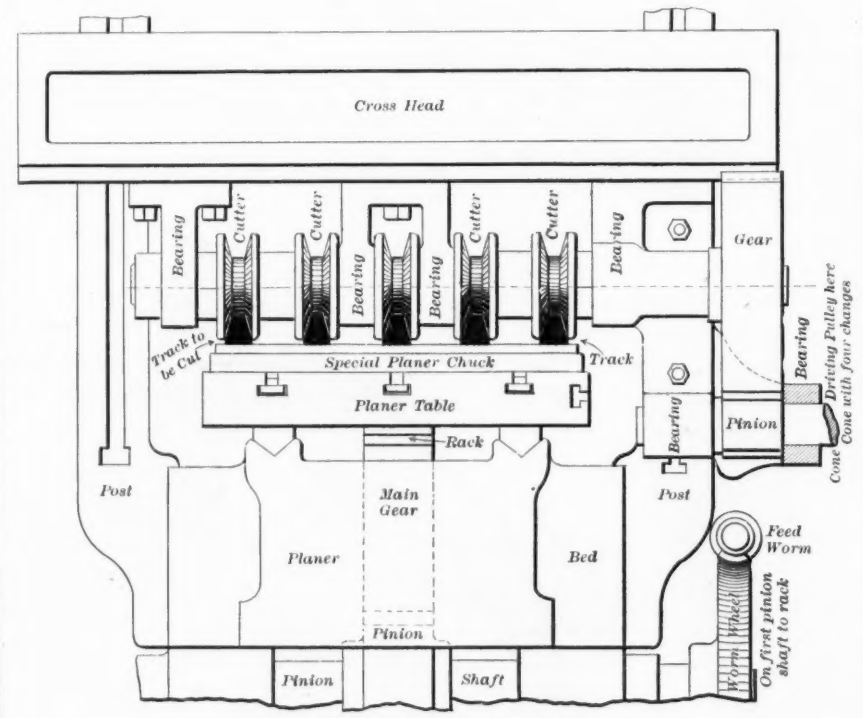
In designing a large circular or rotary cutting machine, the long table for holding the work must, of course, have its main feed in the direction of its length, but there should be a transverse motion either to the cutter or table, great enough to meet the requirements presented.

It will be seen therefore, that a machine tool can be designed to do any variety of work brought to a machine shop, if proper thought is exercised in first putting the details of this work on paper, and we hope to see in the near future more special rapid cutting machinery, thus reducing the first cost of many machines that are now, to say the least, somewhat extravagant in construction.

The average electric dynamo and motor can both be built wholly by special machinery, except perhaps the winding of the armatures, thus reducing their present cost, and at the same time placing them in the class of interchangeable machinery.

Locomotives are now largely built by special machine tools and fixtures, this system having been adopted by many builders fifteen or twenty years ago. There is plenty of room, though, for improvements in special tools for locomotive work, as many of the machines in use are not fitted with the continuous cutting tools, nor are they convenient in handling. In a word, the manipulation of metals in a machine shop is, under fairly favorable circumstances, more or less expensive.

We must use steel or some other material equally hard to remove the surfaces of metals, and there is an economic limit to any cutting tool; yet we must all admit that usually heretofore, the tool has been able to do more work than we have as a rule assigned to it, and it is therefore necessary to build machines strong and convenient enough to get all the work we possibly can from a continuous cutting steel tool. We think the American engineers, toolmakers and master mechanics are equal to the occasion.




RAPID CUTTING SYSTEM.

## English Marine Engines.

In a paper on "The Progress and Development of the Marine Engine," read by Frank C. Marshall before the Institution of Naval Architects (England), the author referred to a paper read by him in 1881, in which he showed that in 1872 the average consumption of coal by marine engines was 2.11 pounds per hour per indicated horse-power, while in 1881 it was only 1.828 pounds, a decrease of 13.38 per cent. The piston speed in 1872 averaged 376 feet per minute, and in 1881 it was 467 feet. The average working pressure was 52.5 pounds in 1872, and 77.4 pounds in 1881.

The paper read in 1881 concluded as follows: "As increased pressure means increased efficiency, there does not appear any reason why the standard of 150 pounds should not be sought as that of the future." In his present paper Mr. Marshall says:

In the six years which have since passed, very great progress has been made in all these points. As regards economy of fuel, the greatest step taken has been the introduction of the triple expansion engine, which, since the successful work done by those of the screw steamer Aberdeen, which commenced running in 1882, have come to be practically universally adapted for all new merchant steamers, as well as for all new war vessels, and 150 pounds the normal working pressure. In Mr. Hall's paper [to which the author had previously alluded] the results are given of several voyages made with cargo steamers, running at moderate speeds, with an average consumption of 1.512 pounds of coal per indicated horse-power per hour with triple expansion engines, against 1.955 pounds with ordinary two-cylinder compound engines in vessels engaged in similar trades, showing a reduction of 22.6 per cent. These figures speak for themselves, and I think we may reasonably expect that a careful and patient attention to details and proportions of the present type of engines and boilers will result in at least some additional economy, in the same way that small improvements in design led to the progress which my previous papers recorded as having been achieved in the now old type of double compound engines between 1872 and 1881.

Upon the subject of forced draft, we extract the following:

Intimately connected with economy of fuel, and also with the weight of engines in proportion to their power, to which I shall presently again refer, is the question of forced draft. As some kind of artificial draft is now universal with all war vessels, and is becoming common in merchant steamers, it will be interesting to notice the first steps taken for the introduction of the system. At the outset it must be distinctly borne in mind that forced draft is now applied in different cases with extremely opposite ends in view, and as an engineering question its success or the reverse depends upon the way in which it fulfills the conditions for which it was designed. In a few mercantile and in war vessels generally, especially in vessels of torpedo boat and torpedo cruiser type, this system has been adopted primarily, if not solely, with the view of obtaining a much greater power with a given weight of boilers than could be obtained with natural draft. Boilers worked in this way, and having a limited amount of absorbing, or as it is usually called heating, surface, cannot be expected to transmit so great a proportion of the heat of combustion to the water as when they are worked under ordinary conditions, consequently they are somewhat less economical of fuel in proportion to the power developed. If, therefore, the system of forced draft as applied to war vessels were to be looked at solely from the coal consumption point of view, it would no doubt be considered to be a great failure, but considering the way in which it meets the requirements actually sought for, it is a great success, and has contributed more than any other single improvement towards rendering our war vessels more efficient than formerly.

The first application of this principle to marine purposes in this country was doubtless in torpedo boats with the locomotive form of boiler. The first application to other than torpedo vessels the writer believes to have been due to Mr. G. W. Rendel, formerly of the firm of Sir W. G. Armstrong, Mitchell & Co., who in 1879 placed the contract for the machinery of three cruisers with the writer's firm, the machinery and boilers to be of the least possible weight for 2,400 horse-power, suggesting at the same time the use of forced draft in the boiler furnaces. The vessels were very satisfactorily completed, two for the Chinese government—viz., the Yang Wei and the Chow Yung—and one for the Japanese government—the Tsukuski. On their trials they each gave about the same results, 2,800 horse-power under forced and 1,912 under natural draft, with a speed of 16½ knots and 14.34 respectively.

* * * The universal adoption of some system of artificial draft in war vessels is, in the writer's opinion, the prelude to its general adoption in the mercantile marine, where its advantages would be vastly more important and valuable. Some of these advantages he ventures to submit to the consideration of shipowners, as follows:

1. Reduced size and weight of boilers, with their contents, in the shape of many tons of water uselessly carried during the whole life of the ships, consequent on this increased space and capacity available for freight-paying cargo, as, for instance, affording the possibility of adopting single-ended, instead of double-ended boilers, by which, not only the reduced cubic capacity of the boiler itself, but the whole of that of the stoke-hold, is made available for ship's use.

2. The maintenance of uniform pressure of steam under all conditions of weather or climate, or the working and cleaning of fires.

3. The complete ventilation of the stoke-holds and the engine rooms in hot climates and under all weather.

4. Greater control over the whole of the operations connected with the generation and maintenance of steam.

Engineers are constantly asked, Will it not be wasteful of fuel and shorten the life of the boilers? The writer would unhesitatingly answer No to both these questions. With regard to the first, due attention being had to the proper proportion of grate and heating surface and disposition of the same, no increased waste of heat should or will occur under ordinary careful management.

The durability of locomotive boilers in which more than three times the quantity of fuel is consumed per square foot of grate, and in which the circulation of water is much less complete, and its quality generally much worse, is sufficient answer to the second question.

## LETTERS FROM PRACTICAL MEN.

### Mechanical Drawing.

*Editor American Machinist:*

When Mr. Meyer's first paper on "Shade Lines" appeared, the writer was in hopes that the readers of the AMERICAN MACHINIST would take up the subject and discuss it thoroughly while the opportunity presents itself; the writer, however, shrank from entering the battle-field, as there is a great deal of ground to be covered. But now that Prof. Sweet, whose articles are always interesting and instructive, has broken the ice* it is to be hoped that we will secure a thorough discussion before the snbject is dropped. As the writer's experience has given him convictions somewhat different from either of the gentlemen now in the field he desires to give his views for what they may be worth.

In regard to Mr. Meyer's articles as a whole, Prof. Sweet's compliment is just, for they are certainly very thorough and are well written, but it is a matter of regret that the man has not yet made his appearance who has independence enough to step out of the old rut in which teachers are plodding.

Now, the questions which the writer would like to see discussed are twofold:

1. "Shade lines."†
2. Relative position of different views.

In regard to the "shade lines" the writer would insist on abandoning them altogether, on the ground that they have no value whatever, neither from an artistic nor from a practical business point of view. To examine the truth of this statement let us use some of Mr. Meyer's illustrations. It is said that "the dark lines $k\ l$ and $l\ i_2$, Fig. 205, indicate that something projects from or stands on some other surface." To fifty per cent. or more of intelligent mechanics who work from drawings these dark lines do not mean anything whatever, as they have never learned the use of such lines, yet they always know what the drawing calls for. A great many never even notice a difference in the lines, if it really exists, and if they do it is is not sufficient to know "that something projects." To enable the mechanic to make the object represented he must know how much it projects. To give this information, Fig. 204 is introduced, as another view of the object, where the length of the projection $g\ i\ h\ j$ can be measured. We must, therefore, have two views at least‡ to convey a correct idea of the complete form of the object, and having the two views they give this information without regard to the shade lines. What, then, are these shade lines good for? "Oh," the advocates of shade lines will say, "they help to show the form." Yes, they help to waste time in making them. They help to make the light lines appear obscure in a great many drawings, in consequence of being made too light when shade lines are used; especially is this true of blue prints and other drawings, when they become dirty by use in the shop. If the light lines were made heavier and the shade lines somewhat lighter so as to make them uniform, the result would always be more satisfactory.

Besides the above, there is only one more reason given for using shade lines, and that is that they make a drawing look better. To this we would answer, Yes; they do make a drawing look better, from the principle that dark lines always give a better appearance to a drawing than light ones, so that by making the light lines heavier—same as the others—the drawing will look still better. To compare the two methods, Figs. 204, 204*A*, 205, 205*A* have been placed side by side. There is a kind of restfulness to the eyes in passing from a light line drawing to one with heavy lines. Figs. 204*A* and 205*a* will make better blue prints, and they will wear better in the shop, than the light lines in Figs. 204 and 205. There is also some difference in the time required to read a drawing, since a heavy line drawing can be read almost as far as it can be seen, while the fine lines become so obscure sometimes, after the drawing has been in the shop a while, that it is necessary to bring it very close to the eyes, and strain them almost out of their sockets in the effort to chase the fine-haired lines as they disappear under the inevitable coating which the shop gives them, and then faintly reappear at another point. It should be remembered that mechanical drawings are made primarily for business purposes, and not for artistic effects; hence anything which does not contribute to the economy of the work produced, all things considered, should be promptly discarded. If a drawing is to be made for artistic effect, then it should be "shaded up," in which case the so-called shade lines are not needed at all.

The best proof that shade lines are worse than useless may be found in actual practice. In examining promiscuously the drawings of thirty men in one of the best shops of the country, the writer has found that twenty of them used shade lines; three made such a slight difference in the lines that it would be a slur on the drawings to call them shade lines; two used shade lines sometimes and sometimes they did not; five did not use shade lines at all. Not one of those using shade lines used the teachers' method. They all used the draftsmen's method, which Prof. Sweet would like to have taught. Now, if shade lines are worth anything at all, such a diversity of practice must create some confusion among the mechanics who do the work in the shop. Experience, however, does not support such a conclusion. During twelve years of experience with drawings, the writer has not met with a single case where a mistake was made, or even a question asked, in consequence of the shade lines not being drawn properly, or omitted altogether.

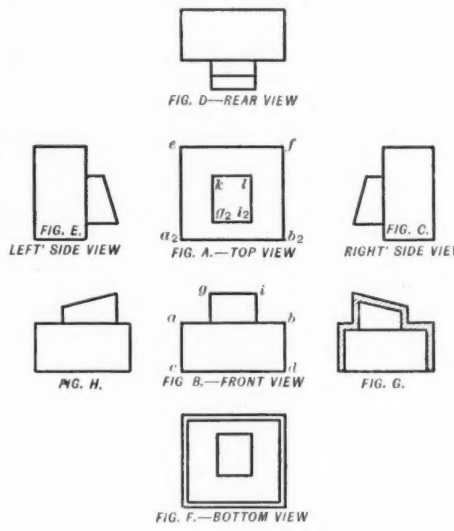
Now if shade lines are to be used at all, the writer would take sides with Prof. Sweet and urge the adoption of the draftsmen's method in the schools. But if we were to change from the teachers' method to that of the draftsmen, then the same reasons would require us to discard shade lines altogether and adopt what might be called the common sense, the practical, or the business method. The term business method would be, perhaps, the most preferable, because business methods are supposed to be those which will produce the best and most economical results.

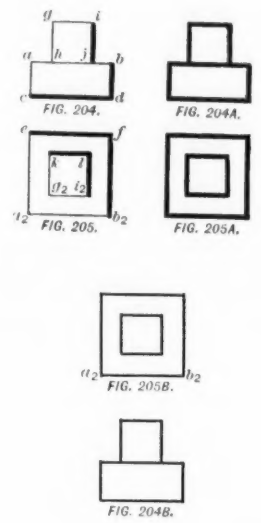
Now it may be pertinent to inquire more critically why we should be asked to abandon the teachers' method, which is universally taught in the schools and colleges, and substitute something else for it. Why should the teacher adopt the draftsmen's, or any other method of which he seems totally oblivious as to its existence? What is this draftsmen's method? How did it originate, or where did it come from? The only answer the writer can find to these questions, in print, is, that the draftsmen's rule is that all lines to the right and bottom of all views of an object should be heavy or shade lines. But how and where did this rule originate? What is the cause of its existence? The only source from which the writer is able to find an answer to these questions is in his own experience, and as he believes it to agree in substance with many others, and believing himself to be no lazier than the rest of humanity, he hopes to be pardoned for using his own experience as an example.

Like most draftsmen, he learned the teachers' method at school. Equipped with this he went into the shop to apply the principles taught him. But he soon found that to shade the "plan" differently from the "elevation," he had to stop at intervals while inking, to "look up," and see whether he was working on the plan or the elevation, as he had occasion frequently to "carry along" two, three, and four views at the same time. If working on a plan, of course the rule for the plan would have to be applied, viz., "shade the lines to the right and at the upper side." On the elevation the rule "shade the lines to the right and at the lower side" would have to be applied. Hence the question kept constantly recurring, "should this line be heavy or light?" Then there were frequent cases where neither rule could be applied, so that some sort of a decision had to be arrived at before the lines could be drawn. The necessity of such constantly recurring delays, however short in duration each may be, is annoying and irksome. This gradually led to the adoption of the uniform rule, shade all lines to the right and bottom on all views, there being no restrictions to the use of this rule further than previous education and habit. As to the "previous education" this has, of course, more or less influence with every man to continue as he has been educated, for fear of being judged ignorant of the principles taught. As to the habit, when once formed, of doing a thing a certain way, this is not very easy sometimes to break off and learn a new way. But these restrictions had little weight in view of the annoyances spoken of above, and the simplicity of the rule adopted. Then the writer also found some "consolation" in the fact that he could explain his course by saying that all of his views were "elevations"—that he made no "plans"—in which case the "shading" was still according to the principles taught him. Further encouragement was found from time to time, in the use of this rule, by learning the fact that others had adopted substantially the same course (undoubtedly for similar if not the same reasons). The writer was not aware that he was drifting into the use of the "draftsmen's method," which had been used by them many years before he ever knew anything about drawing.

Although the draftsmen's method was used for a number of years, it never gave full satisfaction to the writer. He still found that it took extra time in making the shade lines, as the pen had to be frequently readjusted for heavy and light lines, or it required two or three strokes of the pen to make a heavy line. Also in making blue prints the result was frequently not satisfactory, as the light lines would not always print well, and to make them heavy enough to print clear without any trouble would require the shade lines to be objectionably heavy. As there was no call for shade lines from a business point of view, the next step was naturally to abandon them altogether, so that the light lines could be made heavier without increasing the others, making them all of uniform width. This was considered as much of an improvement over the draftsmen's method as the latter was over the teachers' method.

Now, in view of the foregoing facts, is it not folly to persist in a practice which is not only useless, but positively harmful when considered from a business point of view?



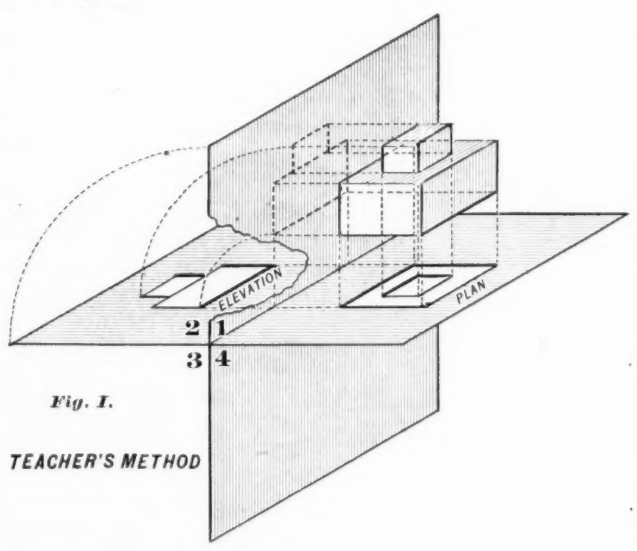




*Fig. I.*

TEACHER'S METHOD

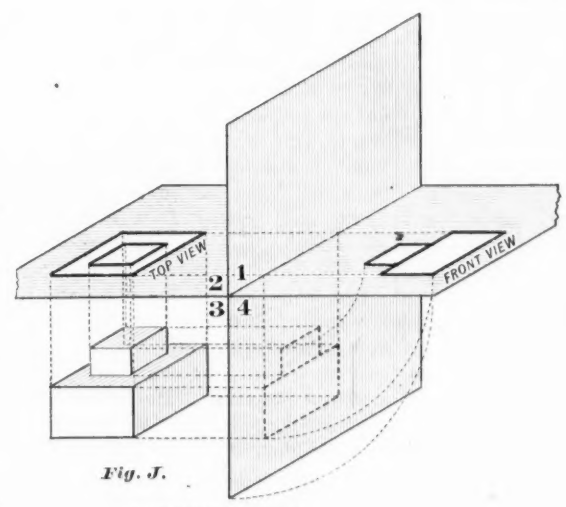



*Fig. J.*

BUSINESS METHOD

RELATIVE POSITIONS OF DIFFERENT VIEWS.

In his twenty-eighth paper Mr. Meyer apologizes for the position he has taken in regard to shade lines, for fear of being charged with the attempt of inaugurating a reform in mechanical drawing. If he had attempted a thorough reform in the teachers' method

* AMERICAN MACHINIST, Aug. 6, 1887.

† The term "shade lines," as applied here, is an unfortunate one, as the *shade lines*, properly so-called, used in finishing drawings with line shading, are entirely different, and have no connection with the heavy boundary lines; but we need not discuss a change in this, as these heavy lines will undoubtedly fall into disuse in time, and the name will disappear with them.

‡ Except in those cases where the form is commonly understood without being drawn, and all dimensions can be given on one view.

there would have been plenty of good reasons for his course of action to need no further apology.

The next thing to shade lines, that needs reforming in the teachers' method, is the relative position that the different views are placed to each other. This "reform" has already made considerable progress in practice, for the new method has been in use for some time in the best shops of the country. By referring to Figs. 204*B* and 205*B*, it will be seen what is meant by this new method, or it better be considered as a part of the business method, for its origin and reasons of its adoption are in general identical with those in regard to shade lines—convenience and economy. In the teachers' method, Figs. 204 and 205, the elevation of the side $a_2$ $b_2$ is drawn on the opposite side of the plan, while the business method has it on the same side, next to it. The reason for this is very simple; it is much more convenient, in reading and making the drawing, to compare the two views with each other. This fact increases in importance as the plan, Fig. 205, lengthens in the direction of $a_2$ $e$, thus removing the elevation farther and farther from the side, $a_2$ $b_2$, in the plan which it represents. The elevation, Fig. 204*B*, is always next to its plan $a_2$ $b_2$, Fig. 205*B*, no matter how long this plan may be. There is nothing more simple than this method when once fixed in the mind.

Suppose we commence to make a drawing. Let us make Fig. *A* as the primary view.*

Having this view, we may regard it as the object itself placed on the paper in the position drawn, so that by looking at it in the direction at right angles to the paper, we would see the sides and outlines as drawn in the primary view. Now we will make a side view from the side $a_2$ $b_2$ and place it on that side of the object (the primary view) next to the side $a_2$ $b_2$. This will give us the front view, Fig. *B*, or whatever other view it may be. In making this view the frequent references from Fig. *A* to Fig. *B* and *vice versa* are just as natural as though we were sitting near the side of a house making a sketch of it. We would look up at the house, then down on the paper to draw a line, repeating this until the sketch was finished. We would not think of running around on the other side of the house, after taking an observation, and making the drawing there upside down, or right side up with our back turned toward the house. Much less would we think of reaching over the top of the house to make the view on the opposite side.

To make a right side view, Fig *C*, of the house, or object, we would view it from that side and make the drawing there as we see it. In the same manner we make the other views, Figs. *D* and *E*. If it be desirable to have a bottom view, either one of the four side views may now be regarded as the primary view or the object and the view drawn next to it in its proper place, as Fig. *F*. The side views, Figs. *C* and *E*, might have been placed by the side of Fig. *B* as primary view, as shown at Figs. *G* and *H*, and the rear view, Fig. *D*, may be placed by the side of either Fig. *G* or *H* as the primary view, etc. Thus we see that either one of the views may be regarded as the primary, in which case the one next to it will be the derived view. Thus A may be derived from *B*, *E*, *D* or *C*. *B* may be derived from *F*, *H*, *A* or *G*; *F* from *B*; *B* from *G*; *G* from *B*; *B* from *H*; *H* from *B*, etc., etc.

To adopt this method and teach it in the schools would not interfere with any of the existing principles of descriptive geometry, for all the change necessary would be to place the object in the third angle of the "planes of projection," instead of the first angle, as shown in Figs. *I* and *J*, the vertical plane of projection being supposed to be revolved down into the horizontal plane the same in both cases.

* There is no call whatever for the terms "plan" and "elevation." The simple terms "top view," "side view," etc., are far more expressive, as they are understood by any mechanic who may not be familiar with the pedantic and unnecessary technicalities.

That there would be vigorous objections to any change in the teachers' method is quite evident, judging from previous discussion, but there is no reasonable foundation for such objections. The only real reason there is for resisting a change, is that it is hard to break away from old habits. Men do not like to set aside what they have learned and learn a new method to take its place until they are compelled to do so from some cause or other. Of course this is a wrong principle to act upon, as it is only a manifestation of the common indolence of humanity. We should be willing to improve any system of practice as soon as we are convinced that it can be improved. The most resistance to any change in the teaching of mechanical drawing will probably come from the teachers, whereas they are the first ones who ought to be willing to accept the dictates of experience, because, to perfect any system, or theory, it must be subjected to practical tests; and such tests, in the present case, cannot be made in the college. They must be made in the shop—in actual business—in order to develop the best methods. Whatever disposition the teachers may make of the subject in the future, one fact will remain, and that is, that the teachers' method will never be used in the shops, in this country at least, though it be taught for all ages to come. As far as the relative location of different views is concerned, the teachers' method will never again be used by those establishments which are now using the business method.

C. A. Smith.

Pawtucket, R. I.

### Cylinder Cock.

*Editor American Machinist:*

The annexed sketch shows a cylinder cock, which is constructed somewhat different from the ordinary cylinder cocks used on locomotives. The valve, as will be seen, has not any wings cast to it, but the guides are formed in the chamber of the upper stem; it is also guided by the spindle cast to valve. This spindle has a long bearing in the lower casing, thus preventing wear and leakage on top of the wedge bar (Fig. *B*). Keeping the valve and spindle smooth—that is, not casting any wings to it—will prevent the oil from gumming and sticking to it, allowing the valve to have free and easy movement, and thus obtain a reliable action of the valve. The hole through the stem is enlarged on the top by tapering it; in this enlarged end the bridges *c c* are cast without materially reducing the necessary area of the opening. These bridges will not allow any obstruction to enter the cylinder cock, which otherwise may keep the valve off its seat, wear, injure or destroy the valve seat. The outlet *d* pitches downwards; this arrangement will always allow the engineer to see the front of the engine, and not obstruct his view by the escaping steam, as will be the case when the outlet *d* is drilled square to the axis of the valve, as is often done.

The wedge bar, shown in Fig. *B*, should, in my opinion, be placed in the slot, so that the wedge part will ride on the bottom of the slot. Putting the wedge part on top, as is usually the case, will crowd the valve and make it wear fast.

Wm. H. Bradt.

### The Lock Question.

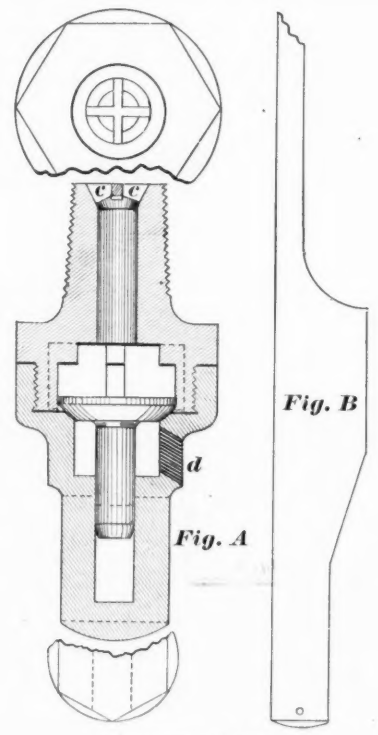
*Editor American Machinist:*

Referring to your article, "Power and Work," in your issue of August 13, I infer from what you say that you assume that it would take an amount of water proportioned to the weight of the boat to lock it.

Let us imagine a boat of inappreciable weight. Would it take only an inappreciable amount of water to lock it? Your statement of the law was for the use of practical men, and has to do only with the practical question. The people to whom it was addressed would reason from it that if the weight of the boat be doubled by loading, that the quantity of water required would be doubled. That is clearly what the article stated, whatever may have been the writer's intention. Now I maintain that the amount of water required is dependent upon the area of the lock and the difference of levels, and that it is independent of the size or weight of the boat. As a simple way of presenting the matter to the mind we may imagine that when the boat has been placed in the lock and the gate closed, it and all the water with it in the lock is raised bodily to the higher level, leaving an empty space underneath. Will the quantity of water then required to fill this space depend upon the boat in any way? And will it be different from the amount that would have to fall from the higher level to fill the lock without any water in it?

The amount of water in the filled lock depends upon the weight of the boat, but part of it is supplied from the lower level without falling, and the remainder falls from the higher level. The first part varies with the weight of the boat; the latter is constant for a given area of lock and a given difference of level.

Now we will go a step further. Practically it takes the same amount of water to lower as to raise a boat, but according to the article "Power and Work" we would reason as follows: In lowering a boat there is no work to be done, therefore it




Cylinder Cock.

will not cost any water. On the contrary, energy will be developed by the falling weight, and we may expect a gain of water in some way.

I have argued the case wholly from a practical standpoint, because the article was for the benefit of practical men. The general law as stated in the article I frankly admit, but unfortunately it can be safely applied in many cases only by those of scientific attainments. The case cited as an example happened to be of this class.

It may be well to state that before writing the above I took a quart pot to represent a lock and a cup to play the part of boat, and found by experiment that it took the same amount of water to raise the cup one inch whether it was loaded or empty. When loaded it was at least twice as heavy as when empty, and should, by the law stated, require twice the quantity of water, or at least a different quantity. E. D. M

[We did not say the water required would be in proportion to the size or weight of the boat, and cannot see how that meaning can be applied to it. It may be said that with a given steam engine it requires more steam to do a thousand horse-power of work than it does to do a hundred, but that would not be saying that it required ten times as much.

We differ from our correspondent in that we think the water required varies as between a light and heavy boat, and as between locking up and down. In locking a boat from the lower to the higher level the water which passes beyond further use for that kind of work in that lock is the lock full *plus* the displacement of the boat. It follows then that more water is required for a heavy than for a light boat. In locking from the higher to the lower level the water used is the lock full *minus* the displacement of the boat. In this case the heavier boat uses less water.]

### Planer Conveniences.

*Editor American Machinist:*

One of the most disagreeable things about a planer is getting the bolts ready. The quantity to keep on hand is uncertain. Sometimes the lengths on hand are not right for the job, then there is the waiting for the blacksmith to make them, which causes delay and dissatisfaction. Often the bolt heads are not square, and the slots in the table are pulled out of shape. To get over these troubles in a measure I conceived the idea of making T nuts to slide easily in the table slots. We milled them off square and true and have used them for three years and they are apparently as good as ever. The slots in the planers are not injured in the least, and the expense of bolts has been reduced to comparatively a very small amount. All we have to do is to take round iron cut into proper lengths. Thread each end and the bolts are ready. The planer slots are always right and the planer man happy. We have adopted these T nuts on all our machines having slots in them, with good results.

Another great help is to line off the table at right angles. A few blocks planed and fitted to the slots and plainly marked to be easily put on helps a man to quickly put work on the planer on line. A little time spent in getting these small things ready pays a very large per cent. on every job done.

A few small jacks, inexpensive, simply a thick nut with a set screw, are very handy about a planer. W. F.

### Railroads in Japan.

A reporter of the San Francisco *Examiner* has been interviewing two Japanese travelers, one of whom speaks as follows about railways in that country:

"We have about five hundred miles of railway in Japan, and we are at this moment building railroads in twenty-four different places. Hitherto our roads have been detached and disconnected—a few miles projected here and there. We are now uniting these detached sections in continuous lines, and pushing out with other lines as well. Railway building is the topic uppermost with everybody. The Mikado is most enthusiastic regarding it. In the next five years we shall have many railroads constructed, and Tokio will be the great center. It has five already. Both narrow and standard gauge roads are being built. We get the rails from various countries, but chiefly from England and Germany, as well as the cars and locomotives from the latter. As we are a very imitative people, however, we shall be able to make our own cars and locomotives in five years." Messrs. Tanaka and Oyatsu left their home in Tokio in May, crossed the Indian Ocean, thence to Marseilles, Paris, London, and the cities of this country. "We are now faster than ever adopting American customs," said they. "We are now wearing clothes in the same style, and building the same kind of houses We have street cars in Tokio, and are going to have more there, and also in Nagasaki and other cities. The cars we get from America. We would have had more street cars ere this, but we use the Jinrikisha, or man-strength car. It is a cart on two wheels, drawn by a man. It is very convenient. Japan is the only country that has it."

### New Method of Casting Cannon.

John F. Allen, of New York, has patented a method of casting heavy guns of steel or iron in which a portion only of the gun is cast at one time, using a flask made in sections. The following, from Mr. Allen's description of the process, will make it understood:

In operation the inner surface of the firebrick lining of the first flask, having been thoroughly heated, is ready to receive the molten metal, which may be poured in until it is nearly full. Should the metal used be steel containing a fraction of one per cent. of carbon, it may be fluxed and tested or alloyed in the usual manner, to secure the

desired quality, either before or after pouring.

I suggest covering the surface with a layer of pulverized beauxite (ore of aluminum) for the purpose of lowering the melting point and preventing the radiation of the heat from the surface of the molten metal.

As the metal is poured into the flask, that part in the center where it comes in contact with the water tube will solidify or crystallize quicker than the outer portion; therefore the crystallized or central part of the metal will not form a horizontal upper surface, but the cooled part will be of conical form, highest at the center and lowest at the circumference, where the metal will keep fluid to a greater depth than at the center. A stream of water or air is, of course, constantly circulated through the core tube. During the pouring and agitating the metal in the lowermost flask, the next flask (which has been previously lined with refractory material) is being heated, ready to be put in place and filled in the same manner as the preceding flask.

The crystallizing metal will now again solidify in the form of a cone, and as the metal is cooler in the bottom of the flask than on top, it will crystallize in layers parallel to its conical surface from the bottom up. In this way the metal in the second flask will, in its crystallized form, represent a cone with a concave base that will overlap the apex of the cone next below, and thus the two cones will be joined, not by horizontal lines, but by being set one over the other.

Each succeeding flask of metal is thus successively joined to the one next below, in the same manner, and thus the cannon, when completed, is composed of metal that has crystallized in the form of overlapping or oblique conical layers.

The great advantage of this process is that the gun will be in a condition to withstand severe vibration very much better than if crystallized in the usual manner, and would require no annealing.

---

One Colonel Pierce is succeeding in getting himself interviewed, let us hope to some purpose, by representatives of the newspapers. The colonel has a modest scheme in view of laying pipes between this country and Europe, and shooting passengers through them at a speed of 1,000 miles an hour. At least he believes this speed is practicable, and, of course, will not stop short of it. As this happens to be just about the initial velocity of a cannon ball, it will be convenient for comparison. "Off like a cannon ball" will have a literal meaning when the colonel gets his tubes working. Experts are said to approve the plan, and all that is needed is money. The speed is to be attained, the colonel says, "by simply using any number of steam fans on the principle of those used in blast furnaces." It occurs to us, come to think, that this scheme is an old friend, but we are not sure the colonel has always fathered it. The last time previous to this that we remember hearing of it through the daily press it was for convenience of travelers between New York and Chicago—time one hour.

---

## Smelting Lead and Silver Ores.

A circular recently received from the Graphic Mining and Smelting Company, Room 63, Adams Express Building, Chicago, says a new smelter is soon to be erected at Tucson, Arizona; that the Mexican Ore Company is now erecting, at El Paso, Tex., a new smelter to contain three furnaces; that the smelters at Socorro, N. M., are building additional furnaces, being unable to handle all the ore offered, and that the Graphic smelter is doing a large and rapidly increasing business in smelting ores received from Mexico. It adds:

Mexico cannot compete with the United States in smelting until some abundant supply of fuel is found, nor so long as lead is worth two cents per pound more in the United States than in Mexico. Under our tariff, lead ores are subject to duty, but silver ores are not. In classifying ores containing lead and silver, if the silver contained in the ore at $1 per ounce is worth more than the lead at 40 cents for each 1 per cent. of lead, the ore is classed as silver ore, and, not being subject to duty, the lead contained in the ore comes in without tax. Under this classification, large quantities of ores carrying lead are imported, without payment of duties.

The outlook for smelting in New Mexico was never better than at the present time. The Inter-State Commerce law enforces fair play in freights, and the construction of additional lines will soon give the inhabitants of that Territory the benefits of competition. The output from the mines of New Mexico and Arizona is steadily increasing, and, with the inexhaustible supply from Old Mexico, will give the smelters of that region all they can do for years to come.

---

## Locomotive Oil Cans.

BY JOHN A. HILL.

The other morning when I came in off a night run there was a letter in the box for me, and it read as follows:

MR. HILL: Since you are so fresh on the torch business, please write a little composition on oil cans, and as there are two to six more oil cans on an engine than there are torches, and as the fireman has to handle them as well as the engineer, any light on the subject would cover twice as many men and four times as many cans.

A SUFFERER.

I am not personally acquainted with this particular sufferer, but out of pure sympathy for his family—more numerous than the Smiths—with whom I am very intimate, I will let out a few hints.

Oil can architects have had many fancies, and built to them, apparently, without asking any questions of those who use the cans. Before you can oil around with a can it must be filled; the fireman usually does this and he often has to do it running and out of a five-gallon can at that. It is not always convenient or possible to strain each canful on the road, so this should be done when the big can is filled in the oil house. Then the hole to fill should be so arranged as to allow of can being set down while a stream of oil is poured into it from an inch and a half screw hole in the big can. Now take a look at Fig. 1; this is a regular can furnished by a certain locomotive works. It has a half inch brass screw cap set at an angle of 45° to the ridge pole of the earth, and in order to fill it the engine must be still, the big can rested on some support and the little one held in one hand, so that the crooked bunghole comes level. Then by standing on one leg, getting his tongue in the northeast corner of his mouth, and using his nose as a globe sight, a man with steady nerves can generally get as much oil in the can as on the deck.

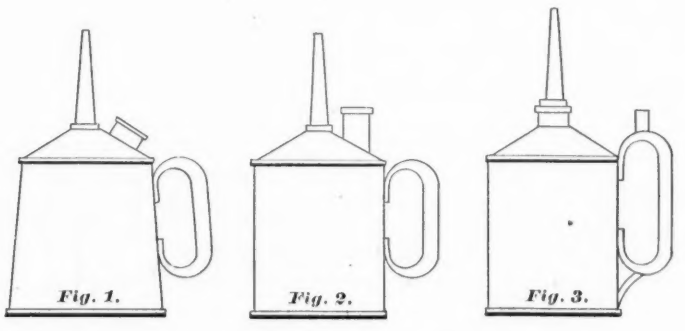


Fig. 1. Fig. 2. Fig. 3.

LOCOMOTIVE OIL CANS.

Fig. 2 is a very common breed of can. It has a cork or a screw for a filling hole, and this has a small punch hole for air, and the stationary spout is often in the way of the big can. If an obstruction of any kind gets into it, you can blow it back into the can to come up again when you are in a hurry; or can get it at the end of the spout and break off about an inch and get rid of it; this is the usual way. If you want to turn the crook of spout up or sideways to reach any out-of-the-way place the vent is stopped, the oil at end of spout is choked off and it commences to run into your hand at the vent.

There is the spring valve can in several shapes, but it is expensive and has too many pieces. A can to be a success on a railroad must be cheap, easily repaired, and durable; this for the company. It must be clean, handy, and quick; this for the road. I would do away with the filling hole and vent slobber and have the spout itself screw on the can, then when stopped up it could be taken off and the obstruction blown away entirely. There would be no screw top or cork to lose, make or repair, the spout could never be in the way of filling, and when you wanted to get a crooked stream into a crooked place the spout could be turned in the thread and keep the vent up, where it belongs. This vent I would place in the bottom of the can instead of the top, as the bottom is the top in use. My can has a very small copper pipe soldered into can below the handle and extending up over it as in Fig. 3, and by using the thumb to control the vent you can control the flow of oil nearly as well as in the valve can. The screw on spout has a half inch blank below it that just slides into the can screw, and this allows you to catch the threads the first time when engine is in motion. The can costs no more than the screw cap stationary spout outfit, and lasts twice as long and is nine times as handy—at least to me.

---

There will soon be made on the Pennsylvania railroad a test of certain new features in ties and rails which are now being used on the London and Northwestern railroad. The tests will be made upon four sections between Pittsburgh and New York, one upon a level, another upon a grade, the third upon a curve, and the fourth upon a bee line. Steel ties are to be used, and the rail will be held by a key resting in a chair on the tie. The chair consists of three steel strips, one of which is placed between the tie and the rail, so as to stiffen the latter locally and prevent the weight from breaking through the thin steel tie. The other two pieces of the chair hold the rail laterally. After the rail is dropped into the chair the key is driven parallel with it and holds it firmly to the gauge. The engineering department of the company is having rails made to weigh 100 pounds to the yard, which are to be put down as an experiment. These will be twenty pounds to the yard heavier than any now in use.—*Philadelphia Record.*

---

The awarding, by Secretary Whitney, of the contracts for building the cruisers and gunboats, appears to have been wisely made. The contracts go to three reputable firms—the Cramps, the representatives of Roach, and the Union Iron Works of San Francisco. This helps to keep these three concerns in condition for doing this kind of work, which is of importance. It is particularly fortunate that one of the contracts goes to the Pacific Coast.

---

## Trial Trip on the Clyde.

The large steel paddle steamer Empress, built to the order of the London, Chatham, and Dover Railway Company, for their services in the English Channel, by the Fairfield Engineering and Shipbuilding Company (Limited) was recently run over the measured mile at Skelmorlie. Notwithstanding the high head wind that was blowing and the heavy sea running, the Empress attained a high speed of 21.3 knots, or rather over 24 miles an hour. The machinery is arranged so that the boilers are worked under forced draft. The steamer, which has a register tonnage of 1,200 tons, is similar in design to the Victoria, built by the same firm last year, having a rudder at each end to facilitate her leaving the harbors. Her dimensions are: Length between perpendiculars, 325 feet; breadth, 34 feet 9 inches; depth moulded to upper deck, 22 feet. She is built entirely of steel, and is divided into eight water-tight compartments. This unusually close subdivision of the hull—a water-tight bulkhead to each 40 feet of the steamer's length—admirably fits the Empress for the passenger service on which she will be placed. The cabin and other accommodation for channel travelers has been carefully arranged for their comfort and convenience. The vessel is fitted with a set of compound, diagonal, direct-acting engines. The boilers, which are constructed of steel, are adapted for a working pressure of 110 pounds per square inch. All the latest improvements, including the electric light, have been provided for the Empress.—*The Mechanical World.*

---

We had hoped that when the Pennsylvania railroad got their Webb compound locomotive, which it is to import, into active service, some knowledge as to the advisability of compounding non-condensing engines would be gained. But in view of the remarkable difference in opinions as to the merits of English and American locomotives, which finds expression in much newspaper discussion, the hope may be delusive. If the Webb compound proves to be more economical than the locomotive of American build, it may be argued that this is due to the fact that the English machine is the better on general principles, and even a little worse for compounding. Or, if the American machine proves the better, will it be because the English engine was compounded, or because the American type is the best? Better import both an English compound and simple cylinder engine, and test the two on an American road, or build an American compound, and test it with the ordinary American locomotive.

---

A Philadelphia correspondent takes exception to the incidental reference by John A. Hill, in a recent article, to the very common employment of tires without flanges on some of the drivers of Consolidation and Mogul locomotives. This correspondent says that blind drivers are not absolutely necessary, and that they are not in use on one of the leading roads of the country, which is quite crooked. As Mr. Hill was not discussing the necessity of the use of tires without flanges, we do not see that he is open to very severe criticism, even though his reference was not literally correct. So far as we can see, he desired to show that there were a good many blind tires in use, and to suggest what he thought might be a remedy for trouble he had experienced with them. We presume he knows that the Delaware, Lackawanna and Western Railroad uses flanged tires on all the driving wheels of their locomotives.

---

The Lowell *Journal* argues for bringing the wind-mill into general use in New England. It reasons that if farmers were to build work shops for their boys, driving them with wind-mills, the mechanical talent would be cultivated, tools would be kept in shape, and many things now done by hand would be done by power. The *Journal* would make a sort of manual training school of the farm workshop, and adds: "And when one has grown up to it, he may find it fully worth his while to do as our big mill owners do with their water privileges—supplement the wind-mill with a small steam engine."

---

The *Paper Mill* says:

Owing to the improvement of labor-saving machinery since its introduction about 1832, says one mill owner, "an amount of manual labor, which, prior to 1830, would have produced one ton of paper, will now produce ten tons," yet there has been a steady increase in the number of hands. The percentage of wages to total cost varies from ten to twenty-five per cent. on various papers, the average being about $1 labor to $4 materials.

AMERICAN MACHINIST

To prevent delays all Communications should be addressed to the Company.

PUBLISHED WEEKLY

BY

**American Machinist Publishing Co.**

HORACE B. MILLER, Pres't and Bus. Manager.

LYCURGUS B. MOORE, Treas. and Sec'y.

**96 Fulton Street, New York.**

F. F. HEMENWAY, Mechanical Engineer.

**Special Announcements.**

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

**Subscription.**

$2.50 a year in advance, postage prepaid in the United States, Canada and Mexico.

$3.50 a year to Other Countries, postage prepaid.

**Advertising.**

Transient, 35c. per line, each insertion.

"Business Specials," 50c. a line.

**The American News Company,**

Publishers' Agents, New York.

**The International News Company,**

11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

NEW YORK, SEPTEMBER 3, 1887.

CONTENTS.

| | PAGE |
|---|---|
| New Automatic Re-Starting Injector | 1 |
| Valve for Gas Apparatus | 1 |
| Was it Spontaneous Combustion? By William J. Williams | 1, 2 |
| Modern Locomotive Construction. By J. G. A. Meyer. Forty-second Paper. | 2, 3 |
| New Self-Setting Bench Plane | 3 |
| Need of Special Tools for Making Standard Machinery. By W. H. Hoffman. Second Paper | 4 |
| English Marine Engines | 4, 5 |
| Letters from Practical Men—Mechanical Drawing. By C. A. Smith—Cylinder Cock. By Wm. H. Bradt—The Lock Question. By E. D. M.—Planer Conveniences. By W. F. | 5, 6 |
| Railroads in Japan | 6 |
| New Method of Casting Cannon | 6, 7 |
| Smelting Lead and Silver Ore | 7 |
| Locomotive Oil Cans. By John A. Hill | 7 |
| Trial Trip on the Clyde | 7 |
| Expert Evidence in Patent Law Suits | 8 |
| The Railroad Disaster in Illinois | 8 |
| Literary Notes | 8 |
| Questions and Answers | 8, 9 |
| Manufactures | 9 |
| Machinists' Supplies and Iron | 10 |

## Expert Evidence in Patent Law Suits.

It has long been our belief that the system under which expert evidence is taken in courts of law in this country is open to grave question, with respect both to its fairness and its expediency. Especially is this to be said in relation to its effect upon patent litigation and the validity of patents. Nor does consideration of this matter involve any question as to the merit of the U. S. patent system as it now stands. The practice under review forms no part of the existing patent laws, and influences the trial of patent suits in a manner not essentially different from the results noticed in other directions.

Expert medical evidence, in the legal trial of criminal cases, insanity cases and will cases, has reached such a point as to be very widely discredited by the community, and very lightly regarded by courts and juries. Penmanship experts in the trial of cases involving forgery and the identification of handwriting, have not occupied an enviable position of late, when in the witness box. In the trial of patent law suits, expert evidence has developed results perhaps even more disadvantageous and inequitable, but the more technical character of the proceedings, and their less sensational nature from the standpoint of daily gossip, have made the facts in such cases less clear to the general public.

The reason for the present unsatisfactory status of expert evidence is not far to seek. Every other witness than the expert witness is supposed to stand on an impartial footing, so far as the infirmities of human nature will allow. Witnesses in all law suits have their bias as individuals, perhaps, but the ordinary witness is sworn to "tell the truth, the whole truth and nothing but the truth," his meager wage of one or two dollars per day is lumped in with the other court costs, and only the final result of the suit discloses by whom it is to be paid. According to the present practice of the courts, it is reserved for the expert "witness," while indeed sworn to give testimony in the interest of abstract justice, to draw a fee ranging from $25 to $250 per day, by direct bargain with one litigant or the other, and presumably to do his best to earn that fee. This state of things makes the so-called expert witness occupy practically the position of a technical attorney, retained not to "tell the whole truth," but largely and almost avowedly to aid the attorney and their joint client, through shrewd prompting, in discovering just where and how the truth may be evaded or covered up, and the opposing party, the judge and the jury, put upon a false scent. Nor, in saying this, should it be understood that technical experts are characterized as perjurers. Whatever blame may attach to the results of their action in such matters, should justly and chiefly, we think, be attributed to a defect that should be remedied, in the system under which our courts of justice, so-called, are operated.

The natural consequences of such a state of things in the legal trial of patent causes are, in very many instances, converting trials into mis-trials, protracting litigation, bringing about needless appeals to higher courts, and frequently reversals of judgment from such courts, after years of substantial denial of justice. The longest purse is likely to employ the ablest experts, and therefore most likely to succeed in obscuring the issue in a cloud of technicalities, to the great detriment of weaker litigants. It may seriously be questioned whether a considerable proportion of the patent litigation of the day is not due to the manner in which shrewd experts, working to earn fat fees in the service of individual clients, while nominally occupying an impartial position, have been able to throw the dust of circumstance into the eyes of justice.

What is the remedy? Nobody can deny either side in a patent infringement case, a will case, an insanity case, or a criminal case, the privilege of employing expert assistants to the attorney or attorneys engaged upon that side.

What can be done, and should be done, in our opinion, is to relegate experts employed to further the special interests of either litigant, to their true vocation as "technical counsel."

Those who are employed as expert "witnesses" should really be witnesses, and they should be selected, not by either litigant, but by the court, in the interest of justice. Each individual so chosen, should, during the pendency of the particular suit in which he is engaged, be in effect a temporary officer of the court. His fees should form part of the regular court costs, to be paid by the losing party. Being employed by the court to find out the truth, and not to cover it up, he would become for the time being a sort of technical representative to whom the judge would confide the duty of making, under due restrictions, a certain limited range of inquiry, the results of which, when properly presented in open court, would be of substantial and accurate value. We believe there would be no difficulty in selecting one or more competent and trustworthy experts for the purposes of any suit likely to be brought up for trial. Nor does it seem to us doubtful that such a change of system would be beneficial to the interests of the whole community, and to none more than to poor inventors.

## The Railroad Disaster in Illinois.

The recent railroad disaster, in which one hundred lives were lost in a little town in Illinois, was, let us hope, the culmination of the chapter of accidents that have attended travel by rail in this country during the past year. It was so horrible in every respect, and so enormous in magnitude and kind, that nothing more should be required to lead the public to inquire whether it has any rights in regard to safety which a railroad corporation can be forced to respect.

We are not of those who are disposed to add to the senseless clamor against railroad corporations simply because they are corporations. Fault-finding of this sort has done only harm, because it has hardened railroad corporations against attention to just criticisms, and led the people to pay little or no attention to them. But this inexcusable slaughter in Illinois is so well defined in all its points, so entirely without complications in its details, that it provides an opportunity for issue that the public cannot afford to neglect. What ought to be settled is: Has a railroad company the right to kill and maim its patrons at will, by paying an assessed equivalent for the privilege of doing so? Fortunately the question is narrowed down to precisely this, and the issue can be fairly made. If the public is beaten on this issue, then all argument to the effect that in absorbing certain rights that are common, a railroad corporation binds itself to the proper performance of certain duties, ought to cease. For the most valuable of the rights that ought to belong to the public is that of reasonable assurance of safety in traveling. The whole matter is so far above any question of compensation for loss of life that it is revolting to every sense of decency to think of dollars and cents in connection with it. A corporation cannot be hung or imprisoned like an individual, but an interesting question just now is: Is there any responsibility in the management that will enable punishment to be inflicted for crimes in ordinary life considered capital? It is an old question, but it appeals with a new force just now, and it ought to be more definitely settled.

The facts in this case are: A railroad bridge constructed of inflammable material, a season of the year—aggravated by absence of rain for weeks—and a location of the country in which a spark was likely to start an extensive conflagration, a knowledge by the officials that several of the bridges on the road had been on fire; these, and no watch on this tinder bed of a bridge over which an excursion train loaded with six hundred people was to pass. The case presents itself so plainly that no amount of logic will confuse it. A bridge burning for hours ahead of that excursion train, and no official or employe of the road has any knowledge of the fact. The master bridge builder testifying that "the other bridges on the road had been on fire this year, but the fires had been seen in time to prevent accident." That is, fortuitously, something similar to this wholesale tragedy had not occurred upon any one of several other occasions during the summer.

There is no new lesson in this disaster at Piper City. Nothing whatever will be learned of the danger of unsafe railroad operating that was not already known by every railroad man in the country. And there can be but one opinion, that is, that one hundred people—more or less—lost their lives through the gross carelessness and criminal negligence of the officials of the bankrupt road. There is not even room for the plea of economical management; on the contrary, there was lack of ordinary good business management, so far as pecuniary considerations alone are concerned. The risk, in view of the probability of fire and the probable cost in money would not be taken by any business manager of good common sense when avoidable at an expense merely nominal. A million dollars—for the cost cannot be much if any less, if the company pay for the lives lost and the injuries inflicted—would pay for watching their wooden bridges for all time, or for replacing them with those built of iron.

But if this disaster, which could so easily have been prevented, and which the exercise of a trifling amount of common sense and the expenditure of a few dollars in money would have prevented, shall have the effect of working the people up to demand a little common sense legislation on the subject, some good may come of it. As previously remarked, it is revolting to think of paying for human life and human suffering in dollars and cents, and legislation ought to be to the end of preventing railroads being operated as this one was. But while money cannot be made to pay for life, the certainty of having to pay roundly where life is lost through carelessness and mismanagement may be made to conduce to safety in railroad traveling as well as in other things. Altogether too low a value is put on the right of an individual to live. It ought to be increased ten-fold. If it cost a railroad fifty thousand dollars instead of five thousand dollars to kill a man or woman there would be several times fewer killed. If it cost a hundred thousand dollars it is doubtful if a passenger would ever be killed from causes that could be controlled.

## Literary Notes.

The *National Car and Locomotive Builder Supplement* for the year is at hand. It contains 112 pages, mostly devoted to advertisements of railroad tools and supplies. It contains considerable handy information in the way of directories of manufacturers, street railways, etc. Advertisements are indexed. A copy of this is sent gratuitously to every person whose name appears in it; also to all railway officials in the United States and Canada. It is prepared and issued by John N. Reynolds, Morse Building, 140 Nassau street, New York.

## Questions and Answers.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.*

(354) J. D. G., Washington, D. C., asks: **How can I blue gun barrels by the nitric acid process? A.—Apply nitric acid to the barrel until it has eaten the iron a little; then clean, oil and burnish the barrel.**

(355) M. R. O., Buffalo, N. Y., writes: I have a small engine, 3'x4", with ports ¼"x1". Can I get four horse-power from this engine? *A.*—You may by running at 300 to 400 revolutions, carrying 100 to 150 lbs steam pressure.

(356) C. P. B., Kansas City, writes: Please explain the process of melting rubber for casting in moulds, such as rubber washers and bumpers. *A.*—Rubber for casting is not melted, but it is mixed with a compound and kneaded to form a kind of thick paste, pressed into moulds, and then vulcanized. The compound used is, as far as we can learn, a trade secret.

(357) H. A. B., ——, asks: What is the standard width of key-ways in shafts from one inch to seven inches in diameter? *A.*—There is not a standard for the width of key-ways in shafts. The width should be calculated; it depends upon the length of the key, and also on the material of the shaft. The key should be sufficiently large, so as to have strength to resist shearing when the shaft is subjected to its maximum torsional stress.

(358) O. I., Dundas, Ont., writes: Wm. Sellers & Co. have adopted a curved tooth on the worm and rack for their planers. Why is this curved tooth preferable to a straight one with a 76° angle? *A.*—The fact that the firm you name have adopted the curve tooth is evidence that they consider it best for that particular purpose. No amount of theory is likely to be as valuable as their experience in this respect. You will find the merits of different forms of gear teeth discussed at length in works on that subject, to which we refer you.

(359) A. B., Brooklyn, N. Y., writes: Please state the volume of steam per hour which will escape into the atmosphere through an orifice one inch diameter at a pressure of 80 pounds per square inch, and also at 105 pounds per square inch? *A.*—At a pressure of 80 pounds per square inch, 3,146 cubic feet of steam will flow into the air. At a pressure of 105 pounds per square inch, 3,216 cubic feet of steam will flow into the air. Friction has been omitted in these calculations; consequently, if the steam has to flow through pipes, the volume will be less than here given.

(360) A. R., Bay Spring, Mich., writes: I am told that the sudden discharge of steam from a boiler is likely to cause an explosion. If this is true, why are pop safety valves so extensively used? *A.*—The pop safety valve is set to blow off a long way below the danger limit of pressure, and its size in comparison with the boiler is such that its blowing does not create dangerous commotion in the water. If the pressure in a boiler is just about equal to its strength, then suddenly discharging a large quantity of steam may temporarily bring about reaction sufficient to cause the material to give way.

(361) J. E. H., Lynn, Mass., writes: I am running a 5"x12" slide valve engine 126 revolutions per minute, cutting off at ¾ stroke. The work varies from one or two horse-power to full power of engine many times per day. Two days in each week the work is very light. I am told that it would be a great saving in fuel to cut off at 2-5, and run 175 revolutions per minute. Please give me your opinion. *A.*—You are correctly informed. Cutting off sooner and increasing the number of revolutions per minute of the engine will affect a saving of fuel, if your engine is fairly well loaded. But you will have to make quite extensive alterations to your engine to cut off at 2-5 of the stroke.

(362) J. R. B., Holyoke, Mass., asks: Where can I find out the amount to allow for forcing-fits by hydraulic or other pressure? *A.*—About the only way to do this is by experience. Much will depend upon the character of the work. As a basis you can calculate that 1-100 inch is about right for fits between 4" and 10"; then vary as experience dictates. Prof. Sweet, in the AMERICAN MACHINIST of July 7, 1883, details the putting together of a crank-shaft in which the fit was 10" diameter and the same length, the allowance for forcing being 1-100 inch, and the pressure required to force together 90 tons. An allowance advised for car wheels when axles were bored about 4½ inches was .007 inch, and it required from 20 to 30 tons pressure to force the wheel to place.

(363) R. A. M., San Francisco, Cal., asks: 1. In the description of a Porter-Allen engine—cylinder, 44"x48'—the steam ports are given as 18 inches long and 4 inches wide. Is not that an error? Should they not have an area at least equal to one-tenth of the piston? *A.*—Mr. Charles T. Porter says: "When, as in the Porter-Allen engine, separate ports are provided for admission and release, it has been found that the former are of sufficient capacity if they require the steam, in passing through them, to have a velocity of 12,000 feet per minute when the piston is moving at its mean speed. The area of the exhaust I have been in the habit of making 50 per cent. to 60 per cent. greater than this. It will be seen that the piston area in square inches, multiplied by the piston travel in feet per minute and divided by 12,000, gives the port area for admission, whatever may be the length of stroke or the number of revolutions per minute. One-tenth of the piston area would provide for a piston velocity of 1200 feet per minute. 2. Is the Porter-Allen valve patented, and if so, are the patents still valid? *A.*—As constructed and used in the Porter-Allen engine, the valve is patented, and the patents are still in force.


## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*

Brass Gears. See Adv., page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

AirCompressors,RockDrills. J.Clayton,43 Dey st.,NY

Exhaust Tumbl'g Bbls. Henderson B's.,Waterb'y,Ct.

Upright Drills from 20" to 36" inclusive. Currier & Snyder, Worcester, Mass.

For Improved Cooper Stoves, send to Variety Machine Co., Warsaw, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., Y. N.

Robbs' Patent Composition for case-hardening. Send for circular. F. W. Tasney, Paterson, N. J.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Injectors, Ejectors, Oil Cups, Sight Feed Lubricators, etc. Arthur Appleton, 45 Cortlandt st., N.Y.

Ice and Refrigerating Machines. 124 built and all successful. David Boyle, 521 Monroe St.,Chicago, Ill.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 120 Liberty st., N.Y.

A good patent direct-acting Steam Pump Movement for sale. W. J. McLean, Indianapolis, Ind.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt,38 Cortlandt st., N.Y

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N. Y.

Metallic Pattern Letters & Fig's to place on patterns for castings. Knight & Son, SenecaFalls, N.Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Aug. 20, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st.,N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

Press for sale. Quick-acting; hole in bed, 8x5, punches to center of 13-inch sheet; 2¼-inch shaft; also four-spindle Drill. B. W. Payne & Sons, Elmira, New York.

Reed's Engineer's Hand-Book to the Local Board Examinations. Eleventh edition revised and enlarged, with 260 diagrams and 36 large plates. 8vo., cloth, $4.50, post-paid. Catalogue of books free. E. & F. N. Spon, 35 Murray st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York


## MANUFACTURES

The Penn Bridge Company has been chartered at Beaver Falls, Pa.

A shingle and planing mill will be built at Monson, Me., by Alvin Gray.

The Electric Light Company at Fairfield, Me., will put in a larger plant.

O. H. Long, New Orleans, La., is interested in building a hosiery factory.

Work on D. & H. Scovill's new shop at Higganum, Conn., is progressing rapidly.

The Electric Lighting Company, of Sanford, Me., has increased its capital stock.

The woolen mill building at Madison, Me., is 138x58 feet. It will be completed this fall.

The Dexter (Me.) *Gazette* says there are rumors of building large paint works at that place.

The city of Titusville, Fla., has voted to build water-works.

The Sheffield Mineral Paint Company will build a factory at Sheffield, Ala.

The East Tennessee, Virginia and Georgia Railroad will build shops at Macon, Ga.

The Jacksonville, Tampa and Key West Railroad will build a round-house at Palatka, Fla.

Gould Brothers are erecting a brick addition to their shop on John street, Bridgeport, Conn.

The Nashua (N. H.) Gas Company will organize as the Nashua Light, Heat and Power Company.

Large flouring mills, to be known as the Crescent City Flouring Mills, will be built at New Orleans, La.

John C. Hubinger will build a starch factory at Keokuk, Iowa, five acres of land having been donated him.

The works of the Bridgeport Malleable Iron Company, Bridgeport, Conn., will be greatly enlarged by the addition of several buildings.

The Carey Pump Manufacturing Company will begin the manufacture of pumps at Warren, R. I., using the old Mechanics' Machine Shop.

W. W. Carmon has bought the old Wheeler Machine Shop at Lewiston, Me., and will begin the manufacture of steam-heating apparatus.

The Satsuma Lumber Company has bought the mills at Satsuma, Fla., and proposes to go extensively into manufacturing cypress lumber.

The Connecticut River Lumber Company has purchased Carlysle township in New Hampshire, covering a wooded territory of thirty-seven square miles.

The Fairfield Chemical Works, Fairfield, N. H., are putting in apparatus for the production of gas from crude petroleum, to be used for fuel in place of coal.

John Westfall, Lawrence, Kan., has made contracts with parties looking to the establishment of works at Lawrence for manufacturing his patent stock car.

The Homer Wire Fabric Company have ordered from the Gilkerson Machine Works, of Homer, N. Y., steel shafting aggregating more than a mile and a half in length.

The Grand Rapids Electric Light and Power Company, Grand Rapids, Mich., have begun business, and own several patents for improvements used in their system of incandescent lighting.

E. R. Davenport, of Charleston, W. Va., has received the contract from the Council at Pomeroy, Ohio, to construct water-works at that place. The works will be similar to the one used in Charleston.

By authority of the Act of Congress for the enlargement of the navy, the Secretary of the Navy has just set aside $150,000 to be expended for the purchase of tools and plants for the New York and Norfolk navy yards.

B. W. Payne & Sons, engineers, Elmira, N. Y., have issued an illustrated circular descriptive of the W. H. Wood refrigerating and ice machinery, of which they are sole manufacturers. The circular contains interesting information.

Samuel L. Mathers and other Cleveland mining men have leased forty acres of ground next to the Lake Superior Iron Company gold mine, six miles north of Ishpeming. A company to be called the Michigan Company is being organized, and mining will begin at once.

The Hoggson & Pettis Manufacturing Company, New Haven, Conn., send us a very neat paper weight, the top of which is a perpetual calendar. Turning the weight bottom up, a miniature "catalogue" is discovered, which is a list of articles manufactured by the firm.

H. R. Stickney, the noted inventor and machinist, 57 Union street, Portland, Me., has been running an engine four years, the fuel used being kerosene of 120 test. This engine is two horse-power, and requires from three to four gallons of oil daily to run it. This engine is his own invention, and there are now seventeen others of his manufacture being run by coal consumption, as it is adapted to be run by either kind of fuel. He will soon make a compound engine of the same kind.—*Industrial Journal.*

The Stearns Manufacturing Company, Erie, Pa., made during the month 48 boilers, of an average weight of 5,974 lbs., and an average horse-power of 37. Of these boilers, 2 were marine, 24 horizontal tubular, 9 two-flue, 6 vertical, 5 portable, and 2 locomotive. The principal tools in boiler shop are 3 punching machines, 2 rolls, 1 steam riveting machine, 1 drilling machine, and 1 shear. The number of men employed was 37; total days worked, 1,576 of 10 hours each. These boilers were all tested at 150 lbs. pressure, and insured by the Hartford Company.

J. H. Taylor, an employe of the Penn Bridge Works, has received a patent on an arrangement for utilizing natural gas for smelting any kind of ores, metals, or, in fact, anything which may be placed in his patent furnace. By this patent he claims an advantage over all other patents of the kind in the fact that a practical test of his invention and its working can be made in any furnace for ten dollars. The invention promises to further enhance the value of natural gas in the manufacture of iron and other metals.—*Beaver Falls Tribune.*

According to the *Irish World*, the Northwestern Worsted Mills Company has been organized in Milwaukee, Wis., by a number of wealthy men, for the purpose of erecting and operating a large worsted mill. The company will have a capital stock of $250,000; the building to be erected will be 150x200 feet, three stories high; the machinery will be of the most improved pattern, *purchased in Europe*, with a capacity of 1,000,000 pounds per annum, and 250 hands will be employed. The *Irish World* omits to state why this machinery is to be purchased in Europe.

That enterprising journal, the *Daily News-Herald*, of Jacksonville, Fla., urges citizens of that place to establish an "Indurated Fiber Company" in Jacksonville, to work up the abundant native woods after the manner of the concern at Mechanicville, N. Y. It says Dr. Burdon, of Sanford, Fla., is the discoverer of the native maguey and the inventor of a small home-made machine for rapidly separating the fiber of beautiful strands which, when twisted the size of a leaden pencil, will sustain a weight of 2,000 pounds. It predicts that the manufacture of tubes, pipes, ropes, etc., from native wood and plants will some day soon be a paying industry in Florida, and thinks Jacksonville should lead off in the enterprise.

A special telegram from Youngstown, Ohio, says: "Recently capitalists in Chattanooga, Tenn., made a proposition to the owners of the William Anson Wood Mower and Reaper Works here to remove the plant to that city. The matter has been under consideration until to-day, when it was decided to accept the proposition and remove the concern to that city. The company will have a capital of $300,000, of which the Youngstown parties will hold a controlling interest. All the machinery in the plant here will be removed, and the products of the Chattanooga concern will be mowers, reapers, binders, rakes and plows. Extensive buildings are to be erected—much larger than those here, and each department will have a separate building. Contracts for the buildings will be awarded at once, and the removal from here take place in November. Nothing has been decided yet as to what will be done with the building vacated here.—*American Manufacturer.*

Mr. John O'Brien, of John O'Brien & Co., boiler makers, has decided to establish a branch works in Kansas City, provided a site for which he is now negotiating can be secured. In conversation with an *Age of Steel* representative, Mr. O'Brien gave as a reason for his building works at Kansas City that a good deal of his business comes out of the western country tributary to that center; moreover, the Kansas City people themselves would preferably patronize a home industry. Iron and steel can be laid down in Kansas City almost as cheap as in St. Louis; so the difference in this respect would not be material to the extent of handicapping operations at the former place. His chief concern would be, and is, in fact, a location favored as regards receiving and shipping facilities by rail. He desires a track for his establishment to enter the same, and obviate the necessity of hauling material and boilers by wagon. If he can secure this advantage, together with such other advantages as may seem necessary for the practical operation, and the extension from time to time of his plant, he will certainly enter upon the manufacture of boilers in Kansas City.—*St. Louis Age of Steel.*

The P. H. & F. M. Roots Company, Connersville, Ind., write us: "We are overrun with orders, and are unable to fill them all. We are enlarging our works to double their present capacity, and we think we shall be able to fill all orders. Some of our recent sales and orders have been as follows: Newport (Ky.) Iron and Pipe Works, two No. 7 blowers, and engine to drive same; Howard Oil Company, Houston, Tex., one No. 4 iron blower; Sisbues & Deming, Salem, O., one No. 5 wood blower; Burdett Loomis (for Diston's saw Works), two No. 3 iron blowers; Fraser & Chalmers, Chicago, Ill., one No. 5 and two No. 3 blowers; Cooke & Co., New York, one No. 5, one No. 4 and one No. 3 blower; Snead & Co. Iron Works, Louisville, Ky., one No. 6 blower; Edison Lamp Company, one No. 5 P. forge; Perry Stove Company, South Pittsburgh, Tenn., one No. 5 blower; South Pittsburgh (Tenn.) Pipe Works, one No. 5 and one No. 2 blower; Bowles & Co., Cleveland, O., one No. 6 blower; Chicago, Milwaukee & St. Paul Railroad, one No. 4 blower; Phillips & Buttorff Stove Company, Nashville, Tenn., one No. 5 blower.

Champion City Oil Company, of Springfield, O., have practically demonstrated that liquid fuel can be used with great success in the annealing of iron at the Champion City Malleable Iron Company's Works. The burner used was the Chicago Edwards pattern, and is composed of three cylinders, six inches in length, one within the other, each converging into a diameter of about one-third less at the end than the main body of the tubes. The innermost tube feeds air, the next to it supplies the oil, atomizes it, and feeds it in an invisible spray. The outermost cylinder gives the steam, supplying the necessary hydrogen to aid combustion and moisture to keep the burner cool. Combustion takes place, not at the immediate mouth of the burner, but about three or four inches distant. The checker work of fire-brick is about three feet distant, and perfect combustion does not thoroughly take place until the bricks attain a white heat, when the steam becomes decomposed and throws off its hydrogen. So perfect is the combustion that it is claimed that 90 per cent. of the fuel is consumed, and that by this process a saving of 40 to 50 per cent. can be effected over the use of coal.—*Western Manufacturer.*

## Machinists' Supplies and Iron.

NEW YORK, Aug. 18, 1887.

Iron—There is no change in the market for American pig. The demand just about equals the output. Standard brands of No. 1 X Foundry are quoted at $21 to $22; No. 2 X, $19.50 to $20.50; Grey Forge, $17.50 to $18.

Scotch Pig—There has been a fair demand for Scotch brands. We quote Coltness, $22.50 to $23; Gartsherrie, $21.50 to $22; Summerlee, $21.50 to $22; Eglinton, $20.50 to $21; Dalmellington, $20.50 to $21.

Lead—Prices are nominal, there being no business of consequence. Common Western is held at 4.65c., but there are no takers at this price.

Antimony—Hallett's, 8¾c; Cookson's, 9c. to 9¼c.

Copper—Prices are a little better than last reported. Spot has sold at 10.75c.

Spelter—Refined, 5¾c. to 6c.

Tin—Jobbing lots of Banca have sold at 24c.; Straits and Malacca, 23.75c.

## *WANTED*

*"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.*

Wanted—An experienced man to take charge of pipe foundry. Address Box 49, AM. MACHINIST.

Wanted—Machine draftsman; must be rapid, intelligent and of steady habits; reply, stating experience. P. O. Drawer 5,110, Boston, Mass.

A first-class mechanical engineer and draftsman, with long experience, is open for engagement; best references. Address Box 53, AM. MACHINIST.

Wanted—A good tool-maker, a polisher, a driller and a screw machine worker; men used to gun work desired. Address Wm. Lyman, Middlefield, Conn.

Wanted—A capable man as superintendent of a first-class machine shop specialists in Ohio. Address, with experience and salary expected, Ohio, AM. MACHINIST.

Wanted—A first-class mechanical and steam engineer for installing steam plants, capable of making plans and accustomed to handling men. Address X. K., care AM. MACHINIST.

Wanted—Position by young man 10 years as machinist and draftsman; some experience in designing and making tools and special machinery. Address Steady Habits, care AM. MACHINIST.

An expert in designing and constructing pumping and general machinery is open for position as supt. and chief draftsman; been 27 years with one of the largest firms. Expert, AM. MACHINIST.

Wanted—A first-class machinist, experienced in steam pump work, as working foreman of a small shop near the city; steady employment to the right man. Address, with particulars, Box 50, AM. MACHINIST.

A first-class mechanical engineer and draftsman, with theoretical knowledge and extensive practical experience in designing, estimating and constructing, is open for an engagement. Address D. E. C., P. O. Box 568, Chicago, Ill.

Wanted—Position as superintendent or draftsman by thorough mechanic, with ten years' experience on machinery and hardware; used to handling men and getting up tools for interchangeable work. Address X, AM. MACHINIST.

Wanted—An experienced draftsman, with good mechanical knowledge, for machine shop working on specialties near Boston. Address, with small sample of work, stating salary expected and references, Box 52, AM. MACHINIST.

Wanted—A first-class foreman, who thoroughly understands foundry management in all its details, for an iron foundry running on special work, located near Boston, Mass. Address, stating references, Box 51, AM. MACHINIST.

Wanted—By a business man who is a mechanical engineer, a position; understands the necessity of doing business for the purpose of making money; is practical in getting up cost, not for curiosity, but for money-saving reasons; can design some classes of machinery; would want a good salary, which he could earn in a position proper for him. Address Nemo, AM. MACHINIST.

## ✢ MISCELLANEOUS WANTS. ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion.*

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Stationary boat engines, boilers, best, cheapest, 1 to 10 H. P. Washburn Engine Co., Medina, Ohio.

Hydraulic press wanted (second hand), about 36x28. Send price and full particulars to J. M., P. O Box 3413, New York city.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. I. A. Weston & Co., Syracuse, N. Y.

The Petroleum Resolvent will clean your boilers and keep them clean at a cost of ten cents a week; write for circular. Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

A. C. Christensen, 26 Church st., N. Y., mech'l engineer, late chief draftsman at Worthington's. Mechanical and patent drawings of all kinds to order. Patentee of natural gas meters.

For Sale—Foundry and machine shop doing a good business. Parties wishing to engage in this business will get a bargain by calling on or addressing the Albion Foundry and Machine Works, Albion, Ind.

Wanted—By responsible house, a line of good, reliable, low-priced vertical engines and boilers on consignment; have excellent selling facilities; will keep fully insured and make prompt returns. Address Sales Agents, care AM. MACHINIST.

For Sale—Machine Shop, Blacksmith Shop and Foundry, established 25 years and doing a steady business. Machine shop contains one Pond planer, 36"x36"x10' capacity; one Putnam lathe, 20" swing, 13' 6" between centers; one lathe, 24" swing, 13' between centers; one heavy lathe for boring, swing, 8' gap, 18" wide; one upright drill, 18" from post to center of spindle; one double-wheel emery grinder; one pattern lathe, one, 12" swing, 4' between centers; two engines—one, 8"x12"; one, 9"x16"; boiler, 40"x10'; 8" flues. Blacksmith shop has one Sturtevant power blower and one new large-sized Roots' hand blower; also brass furnace, with power blast pipe The foundry equipments are second to none in the country for the class of work required; there is a good assortment of well-made standard patterns, wood and iron; the wood flasks are well made and bolted. There are also 130 two-parted iron flasks of various standard sizes, each size fitted up in duplicate, so that any two parts will fit together, and they are so arranged that two, three or more parts can be built up for deep work and bolted together. The cupola has a capacity of 11,000 lbs.; ladles—one 2,700 lbs., 1,700 lbs. and 700 lbs., two 500 lbs., two 225 lbs. capacity; one McKenzie blower; coal grinder or mill and rattler; one brick oven and one stove oven; the latter is 18"x60"; the brick, 6'x7'; one foundry gib crane and one traveling crane for casting. The travelers will carry the 500 lb. ladle from the furnace to any part of two-thirds of the floor space; it has a convenient lever arrangement for raising the ladle during the operation of pouring. This practically dispenses with all the hard work while casting. For further particulars, address Iron Moulder, care AM. MACHINIST.


BRADLEY'S HEATING FORGES.

ESTABLISHED 1882.

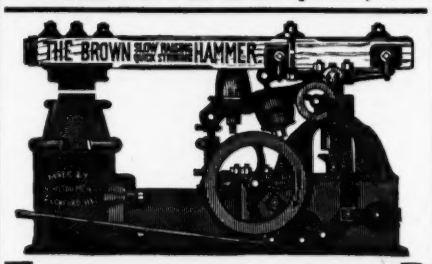
For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1882.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.

BRADLEY & CO. Syracuse, N.Y.




THE BROWN HAMMER STRIKES A BLOW WITH Double the Velocity That it Raises the Hammer. A NEW MOVEMENT! SEND FOR DESCRIPTION. KNOWLTON MFG. CO., KING ST., ROCKFORD, ILL.

For Sale.

Large Foundry, Machine and Boiler Shops.

ONLY FOUNDRY IN CITY OF 30,000 POPULATION.

Doing a good business and well established. Build Corliss and all styles of Slide Valve Engines, Mill Machinery, and Architectural Iron Work. Modern machinery and large stock of patterns. Brick Buildings and five lots 50x150 each. Reasons, ill health of Pres't and Sup't.

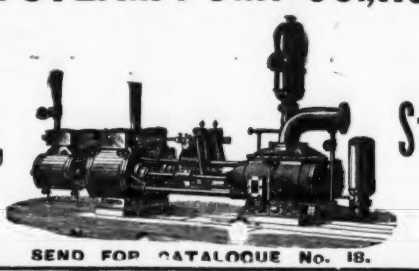
TERMS.

One-third down, balance in 5 years at 7 per cent. if desired. Any parties meaning business will please address

J. P. DENNIS, Sioux City, Iowa.

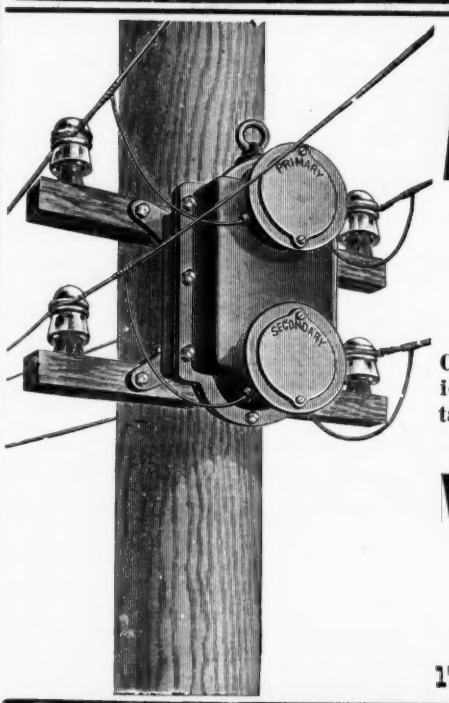
THE DEANE STEAM PUMP CO., Holyoke, Mass.

BUILD Water Works, AND Steam Pumping ENGINES MACHINERY.



SEND FOR CATALOGUE No. 18.

IF YOU WANT A SHAPER, PLANER, DRILL, LATHE OR SPECIAL MACHINERY, WRITE TO THE HENDEY MACHINE CO., SEND FOR A CATALOGUE. TORRINGTON, CONN.




—THE— Alternating SYSTEM.

Incandescent Electric Lighting from Central Stations, made Universal, Economical and Profitable, irrespective of distance.

THE WESTINGHOUSE ELECTRIC CO. PITTSBURGH, PA.

EASTERN OFFICE, 17 CORTLANDT ST., NEW YORK.

THE M. T. DAVIDSON IMPROVED STEAM PUMP,

MANUFACTURED BY DAVIDSON STEAM PUMP COMPANY.

WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.

PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.

NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. VACUUM PUMPS of the highest efficiency. FILTER PRESS PUMPS. Air, Gas and Acid Blowers. AIR COMPRESSORS. Etc. BUILT BY

GUILD & GARRISON, Brooklyn, N. Y.

COOKE & CO., DEALERS IN Machinery and Supplies, 22 CORTLANDT ST., NEW YORK.

AGENTS FOR

The Waters Perfect Governor.

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also,

SUPPLIES

For Machinists, Railways, Mills, Mines, Etc.

Please send for circular and state that you saw the advertisement in this paper.

STEPHENS PATENT VISES.

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick-working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular.

TOWER & LYON, 95 Chambers Street, New York. Successors to MELVIN STEPHENS.

ECONOMICAL STEAM BOILERS A SPECIALTY.

SEND FOR PRICES. Pond Engineering Co. ST. LOUIS, MO.

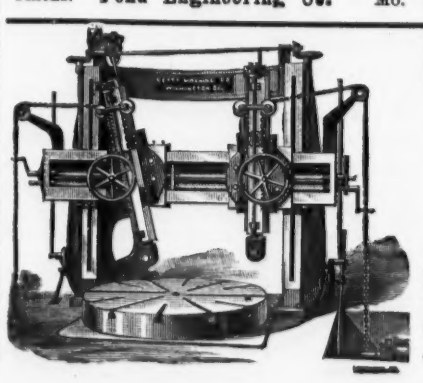
MANUFACTURING BUSINESS for SALE

A desirable and well-established manufacturing business, making from twelve to fifteen thousand dollars per annum, is offered for sale, because of the advanced age of the proprietor. Parties desiring to purchase may apply to

ROGERS, LOCK & MELBORN, 28 Erie Street, Buffalo, N. Y.

93 Liberty St. NEW YORK. | 113 Federal St., BOSTON.

IMPROVED PUMPING MACHINERY | For Every Class of Work | SEND FOR NEW ILLUSTRATED CATALOGUE.



Boring and Turning Mills MADE BY BETTS MACHINE CO. WILMINGTON, DEL.

NOTE THE FOLLOWING ADVANTAGES.

Positive feeds, no friction.
Spindles entirely independent, can be moved simultaneously in opposite directions with different grades of feed.
Spindles not round, but of such shape as will allow ready adjustment for wear.
Great range of feed and abundance of power.

# NICHOLSON FILE CO. —SOLE MFRS. OF

FILE CARD.

## Files and Rasps

FILE BRUSH.

**Having the Increment Cut.**

The illustrations herewith presented, exhibit more convenient and durable forms of **File Cleaners** than are usually found, the majority of those in use being rudely devised and troublesome, and we believe for this reason, those of our manufacture will find a ready sale. Machinists and others who have not already given them a trial, will find it to their advantage to order the **File Card** and **File Brush** at once.

**Manufactory and Office,**

**PROVIDENCE, R. I., U. S. A.**

# THE NEW "GRESHAM" PATENT AUTOMATIC RE-STARTING INJECTOR

"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of re-starting automatically, immediately after interruption to feed from any cause."

**SEND FOR CATALOGUE.** **RELIABLE AND CHEAP.**

Sole Manufacturers in the United States and Canada.

## NATHAN MANUFACTURING CO.

92 & 94 LIBERTY ST., - - - NEW YORK.

**WHY THIS IS PUT HERE!**

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

## NEW PULSOMETER,

**THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.**

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

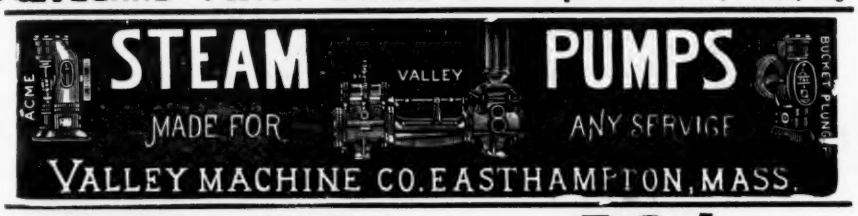
Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

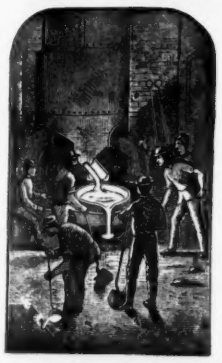
**PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.**

**Established in 1874.**

## CLEVELAND TWIST DRILL CO.

24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.



## T. SHRIVER & Co's IRON FOUNDRY,

333
East 56th St.,
NEW YORK.

Contracts Solicited for Machinery Castings in regular supply.

## ROOTS' Force Blast Rotary Blower

FOR
FOUNDRIES, SMITH SHOPS, PNEUMATIC TUBES, VENTILATION, ETC.

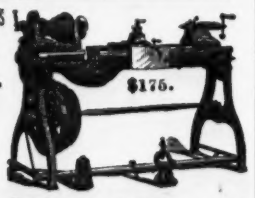
SLOW SPEED,
POSITIVE BLAST,
PERFECTLY BALANCED,
**Best Mechanical Construction.**

P. H. & F. M. ROOTS, Manufacturers,
CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt. } 22 Cortlandt St.
COOKE & CO., Selling Agts. } NEW YORK.

*In Writing, Please Mention This Paper.*

SEBASTIAN, MAY & CO.'S
Improved Screw Cutting
FOOT or POWER **LATHES.**



Catalogue of Lathes, Drill Presses and Machinists Tools and Supplies mailed on application. *Lathes on Trial.*

167 W. Second St., CINCINNATI, O.

# 56th ANNUAL EXHIBITION OF THE AMERICAN INSTITUTE

OF THE CITY OF NEW YORK,
Will open to the Public September 28.

**ELECTRICAL INVENTIONS**

will have precedence, and form its most attractive feature. Exhibitors in this department should address JOSEPH WETZLER, 175 Potter Building, New York. Other departments and all details to

*GENERAL SUPERINTENDENT,*
American Institute, Astor Place, New York.

LATHE CHUCKS, "THE SWEETLAND CHUCK," DRILL CHUCKS, BELT CLAMPS.

MACHINISTS' TONGS, PIPE CUTTERS AND WRENCHES. WRITE FOR DISCOUNTS.

**OUR**

SPECIAL MACHINERY, DIES, TOOLS, &c. SUB-PRESS DIES A SPECIALTY.

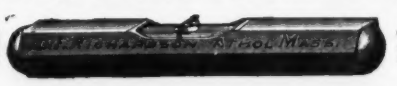
-alogue Mailed on Application.

THE HOGGSON & PETTIS MFG. CO., New Haven, Ct.
Established 1849.

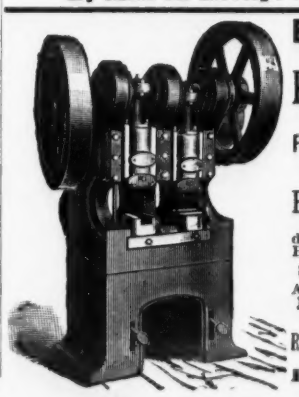
STEEL STAMPS, STEEL LETTERS, FIGURES, STENCILS, BRASS CHECKS, &c.

## Nickel Plated Pocket Level.

No. 11.




2½-in. 60 cents. 3½-in. 75 cents.
**By Mail on Receipt of Price.**

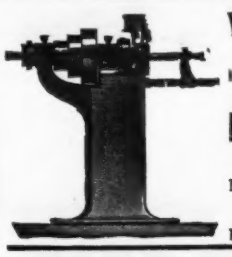


**BEAUDRY'S DUPLEX**

## Power Press

COMBINING
PRESS, SHEARS AND PUNCH.

BEAUDRY & CO.
(Formerly of Beaudry's Upright Power Hammer.)
Sole Manufacturers.
Also manufacturers of
HARD COAL HEATING FORGES.
Room 4, MASON B'DG, 70 KILBY ST., Boston, Mass.

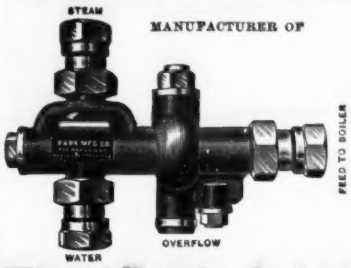


## William Barker & Co.

Manufacturers of
IRON AND BRASS
—WORKING—
**MACHINERY**
140 & 142 E. Sixth Street,
Fr Culvert, Cincinnati, O.

Send for circulars and prices.

## PARK MFG. CO.




MANUFACTURER OF

34 Beach Street, Boston, Mass.

## The Park Injector,

EJECTORS AND JET APPARATUS.

## C. W. LE COUNT,

South Norwalk, Conn.

**REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG**

| No. | Inch. | Price. |
|---|---|---|
| 1 | 3-8 | $ .40 |
| 2 | 1-2 | .50 |
| 3 | 5-8 | .60 |
| 4 | 3-4 | .60 |
| 5 | 7-8 | .70 |
| 6 | 1 | .70 |
| 7 | 1 1-8 | .80 |
| 8 | 1 1-4 | .80 |
| 9 | 1 3-8 | .95 |
| 10 | 1 1-2 | .95 |
| 11 | 1 3-4 | 1.10 |
| 12 | 2 | 1.20 |
| 13 | 2 1-4 | 1.35 |
| 14 | 2 1-2 | 1.45 |
| 15 | 3 | 1.60 |
| 16 | 3 1-2 | 1.80 |
| 17 | 4 | 2.10 |
| 18 | 4 1-2 | 2.75 |
| 19 | 5 | 3.25 |
| Full set of 19 | | $23.60 |
| 20 (ext.) | 5 1-2 | 4.00 |
| 21 (ext.) | 6 | 5.00 |

This Dog has a Very Heavy Boss, so that if the thread should wear Screw can be substituted.

With Steel Screws. Lathe Made and Hardened

When ordering, state as above, whether a full set or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.

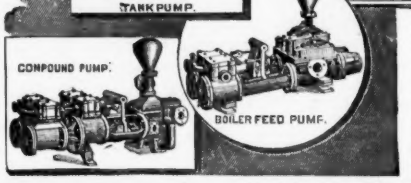
**Le Count's Heavy Steel Dog,**

One Small Set of 8—by 1-4 inches to 20 inch..... $ 6.25
One Set of 12—by 1-4 in. to 2 in .continued by 1-2 in. to 4 in. 13.20

## WALKER'S TOOL HOLDER.

For holding drills and reamers for lathe work. Prevents breaking or slipping. Can also be used for drilling and reaming holes by hand, and for reaming holes under drill presses, etc. Made with double handle, when required.

WALKER MFG. CO.,
CLEVELAND, OHIO.




## THE VOLKER & FELTHOUSEN MFG. CO.

MANUFACTURERS OF
BUFFALO DUPLEX STEAM PUMPS.
CHURCH, BIRD'S ALL & MECHANIC STS. BUFFALO, N. Y.

For Sale at Factory Prices by

A. Aller, New York; S. C. Nightingale & Childs, Boston; Henry I. Snell, Philadelphia; Thos. J. Bell & Co., Cincinnati; Shaw, Kendall & Co., Toledo; The George Worthington Co., Cleveland; Goulds & Austin, Chicago; Kennedy & Pierce Machinery Co., Denver, Col.; Sheriff & Ashworth, Pittsburgh, Pa.; Jos. Baur, Manistee, Mich.; Jas. Jenks & Co., Detroit, Mich.; Wickes Bros. East Saginaw; Adolf Leitelt, Grand Rapids; E. F. Osborne & Co., St. Paul, Minn; Rundle, Spence & Co., Milwaukee, Wis.; Joshua Hendy Machine Works, San Francisco; Flynn & Emrich, Baltimore, Md.; Forbes Liddell & Co., Montgomery, Ala.; Bailey & Lebby, Charleston, S. C.; Pond Engineering Co., St. Louis and Kansas City, Mo.; O. B. Goodwin, Norfolk, Va.; Columbus Supply Co., Columbus, O.

**WHAT USERS THINK OF THE**

**Hall Steam Pump Co., Duplex 91 Liberty Street, New York. Steam Pump.**

We have had two Hall Pumps in use for about a year. We use them for feeding our boilers. They have given entire satisfaction.
R. B. CHILLAS, V. P., Lea Pusey Co., Wilmington, Del.

The Hall pump we bought from thee has worked well and been very satisfactory.
JOSEPH BANCROFT & SONS, Rockford, Del.

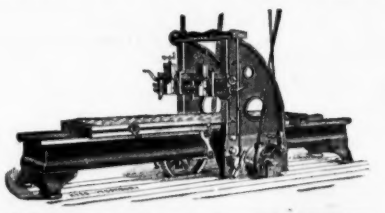
The steam pump furnished about one year ago is doing good service; it has never cost us anything for repairs, and will discharge more water than any pump of its size I know of.
S. P. ROMANS, Deadwood, Dak.

The two pumps have given perfect satisfaction. We can recommend them.
J. HART & CO., Baltimore, Md.

Pump is working very nicely and giving good satisfaction.
RUTZLER & BLAKE, 178 Centre St., New York.

## FITCHBURG MACHINE WORKS.

Manufacturers of
**METAL-WORKING MACHINES.**
Office and Works,
13 to 21 Main Street,
FITCHBURG, MASS.
Send for Catalogue (E.)



# FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON,
North Adams, Mass.

## STEAM HEATING FOR BUILDINGS,

Or, Hints to Steam Fitters. Being a description of Steam Heating Apparatus for Warming and Ventilating Private Houses and Large Buildings, with Remarks on Steam, Water and Air in their Relations to Heating. To which are added useful miscellaneous tables. By Wm. J. Baldwin. Eighth edition, revised and enlarged. With many illustrative plates. 12mo, cloth, $2.50.

"Mr. Baldwin has supplied a want long felt for a practical work on Heating and Heating Apparatus."—*Sanitary Engineer.*

JOHN WILEY & SONS, 15 Astor Pl., N. Y.
Publishers of Scientific and Industrial Works.

**** Will be mailed and prepaid on the receipt of the price. Catalogues and Circulars free by mail*

## UNION STONE COMPANY,

38 & 40 Hawley St., Boston, Mass.

EMERY-WHEEL GRINDING MACHINERY, EMERY WHEELS AND TOOLS.

MACHINERY FOR POLISHING WHEELS, POLISHING BELTS, AND POLISHING BUFFS, AND ALL SUPPLIES PERTAINING THERETO.

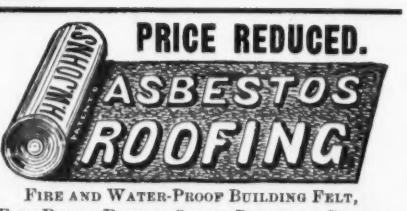
ELECTRO-PLATERS' SUPPLIES.

**B. GRINDING MACHINE.**
1" Shaft. Takes Wheels to 14" diameter. Countershaft with hangers or in machine. Is specially adapted to light work in machine shop, tool grinding, etc.

**HENRY CAREY BAIRD & CO.,**
**Industrial Publishers, Booksellers and Importers,**
**810 Walnut St., Philadelphia.**

☞ Our Catalogue of Practical and Scientific Books, 96 pages 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

## PRICE REDUCED.




FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail.

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

# WORTHINGTON Independent Condensers

ARE NOW IN USE ON ENGINES AGGREGATING UPWARDS OF

**50,000 HORSE POWER**

One of these machines—**the largest Independent Condenser in the world**—is applied to an engine of

**8,000 HORSE POWER**

SEND FOR ILLUSTRATED CATALOGUE

HENRY R. WORTHINGTON
**NEW YORK**
BOSTON PHILADELPHIA
CHICAGO ST. LOUIS SAN FRANCISCO

SAFE ECONOMICAL DURABLE BOILERS
HARRISON SAFETY BOILER WORKS. PHILADELPHIA, PA.
MERITS PROVEN 20 YEARS RECORD

ADOPTED.
THE
Babcock & Wilcox Boiler.

[Copy.] CONSTRUCTION COMMITTEE FOR
Edison Electric Illuminating Co. of New York.

Committee.
E. H. Johnson,
C. H. Coster,
C. E. Chinnock,
John I. Beggs.

ENGINEER'S OFFICE,
Room 53, 16 Broad Street,
NEW YORK, July 28th, 1887.

Engineer, J. H. Vail.

THE BABCOCK & WILCOX CO., 30 Cortlandt Street, City.

GENTLEMEN:—You are hereby notified that your proposals are accepted for water tube boilers, to be used in the three new stations of the Edison Electric Illuminating Company of New York City.

The horse-power required in these three stations will aggregate 8,700 horse-power.

I enclose you herewith contracts in triplicate, covering the boilers now required for station in 26th street.

Please execute contract and return two copies to me.

Yours truly,
[Signed] J. H. VAIL,
Chief Engineer.

Enclosures.

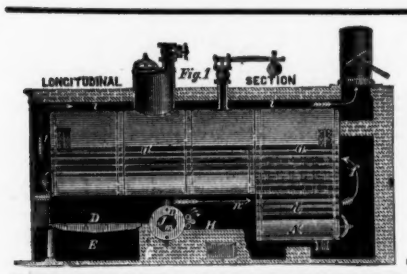
EAGLE ANVIL WORKS,
*Trenton, N. J.*

The Fisher Double Screw Leg Vise.—Warranted stronger grip than any other Vise. Always parallel and cannot be broken.

Send for Circulars.

The Eagle Anvil.—Best Cast Steel Face & Steel Horn. Better than any English anvil. Fully warranted and lower price.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes
FOOT POWER LATHES, SLIDE RESTS, Etc.

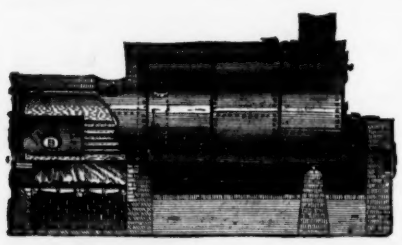



The Bate STEAM GENERATOR

Generates steam rapidly and economically. Constant circulation of water. Easily Cleaned. Furnace produces perfect combustion. Best evaporative duty. Material and workmanship A1. Large number in use.

Infringements Rigorously Prosecuted.

WM. T. BATE & SON,
Sole Manufacturers,
CONSHOHOCKEN, PENNA.



Over fifty years' competition has proven this system of boiler to be the best in every respect. The LOWE BOILER, with all improvements, is the simplest, best wearing, and most economical of any kind of fuel.

Send for description and histories of Steam Boilers and Feed Water Heaters (free) to

BRIDGEPORT BOILER WORKS, Bridgeport, Conn.

THE WAINWRIGHT
Corrugated Copper Tube Expansion Joint.
ABSORBS ALL
EXPANSION AND CONTRACTION IN STEAM PIPES,
And Never Requires Re-packing. Write for Descriptive Circular to
THE WAINWRIGHT MAN'F'G CO., 65 and 67 Oliver Street, Boston Mass.

THE ARMSTRONG MF'G CO. WATER, GAS & STEAM FITTERS TOOLS
BRIDGEPORT, CONN.

CATALOGUES AND PRICES SENT ON APPLICATION

Buffalo Cupola & Forge Blowers.

WARRANTED Superior to any other make.

All sizes and styles of every class of work.

BUFFALO FORGE CO.
BUFFALO, N. Y.

Send for Catalogue and prices.

Hydrostatic Machinery
*PRESSES,*
*PUMPS,*
*PUNCHES,*
Accumulators,
*JACKS,*
*VALVES,*
*FITTINGS,*
Vault Elevators, &c. &c.

WATSON & STILLMAN, 204-210 East 43d St., N. Y.

The Original Unvulcanized Packing
CALLED THE STANDARD—As it is the Packing by which all others are compared.

Accept no packing as JENKINS PACKING unless stamped with our "Trade Mark."

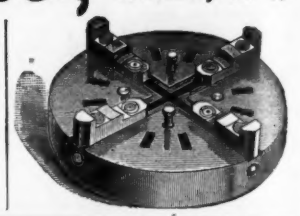
JENKINS BROS. { 71 JOHN STREET, N. Y. / 100 MILK STREET, BOSTON. / 13 SOUTH FOURTH ST., PHILA. / 64 DEARBORN STREET, CHICAGO.

WESTCOTT CHUCK CO., ONEIDA, N. Y.

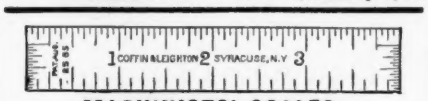
MANUFACTURERS OF
LATHE and DRILL
CHUCKS
SEND FOR CATALOGUE.

GEARED CHUCKS.
Jaws Reversible.

| Diameter. | Capacity. |
|---|---|
| 5 inch. | 5 inch. |
| 7⅛ " | 7⅛ " |
| 10⅛ " | 10⅛ " |
| 13 " | 13⅛ " |
| 15¼ " | 17 " |
| 18 " | 19¾ " |
| 21 " | 25½ " |
| 24 " | 28 " |



BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
BREHMER BROS.
*Machinists,*
440 N. 12th St., Philadelphia, Pa.




MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

A Complete Cutting-off Machine, $4.00
Larger ones which cut to 2 in. $8.00
SENT ON TRIAL.

STERLING ELLIOTT, Newton, Mass.

"CUSHMAN" CHUCKS

Are guaranteed to be right in all respects. Ask to see them at your dealer's, or write direct to the factory. Respectfully,

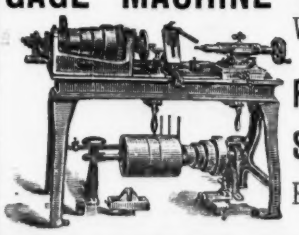
THE CUSHMAN CHUCK CO.,
HARTFORD, CONN.

STOW MANFG. CO., Binghamton, N. Y.

FLEXIBLE SHAFTS,
TAPPING and
REAMING MACHINES,
Portable Drills,
ALSO FLEXIBLE
BORING MACHINES

For Ironing Carriages and Wagons; Boring for Pinning Sash, Doors and Blinds, also for Stair Work.

GAGE MACHINE WORKS,
Waterford, N. Y.



Manuf'r's of
FOX, TURRET
AND
SpeedLathes
AND
Brass Finishers'
TOOLS.

Arthur B. Phillips, Machinist, WHITMAN, MASS.,

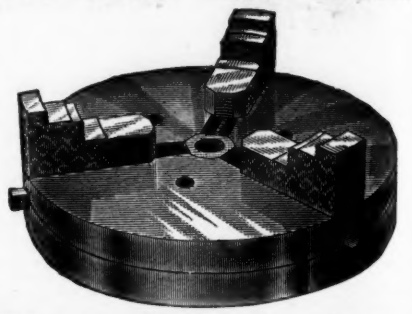
Manufacturer of

Atwood's Patent Power Matcher and Gluer and Stafford & Whipple's Patent Planer and Surface Gauge.

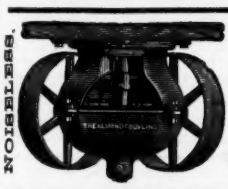
Light Machinery of all kinds Built at Short Notice.
Estimates furnished. Correspondence solicited.

COILS & BENDS
—OF—
IRON,
BRASS and
COPPER
PIPE.
ALL STYLES.
THE
NATIONAL
Pipe Bending Co.
NEW HAVEN, CONN.

ESTABLISHED 1851.
The Horton Lathe Chuck.

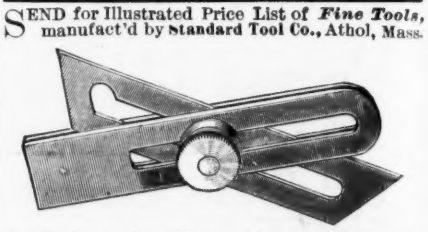


THE E. HORTON & SON CO.
Canal St., Windsor Locks, Conn., U. S. A.




The Almond Coupling
A NEW quarter turn motion to replace quarter turn belts and bevel gears.
T. R. ALMOND, Mfr.,
83 & 85 Washington Street,
BROOKLYN, N. Y.

SEND for Illustrated Price List of *Fine Tools*, manufact'd by Standard Tool Co., Athol, Mass.



Any Tool we make will be sent by mail or express to any address, all charges prepaid, on receipt of price.

PATENTS
R. G. Du Bois, Patent Att'y, 916 F St., Washington, D. C. Good references. Send for pamphlet.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST.

Large Planers.

We have FINISHED the Cross-head and details of 42 and 48 inch Planers and can deliver any length of bed in a few weeks.

The NEWARK MACHINE TOOL WORKS
EAST NEWARK, N. J.

## *Morse Twist Drill and Machine Comoany,* New Bedford, Mass.

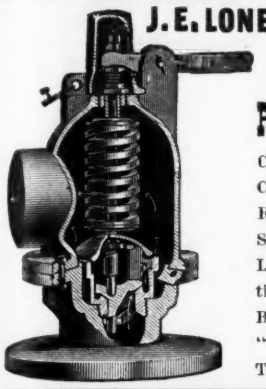
Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

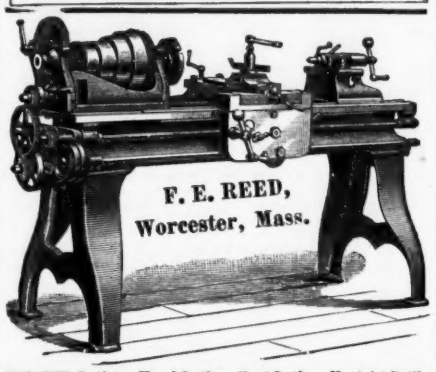
## STEEL BALLS
FOR ANTI-FRICTION BEARINGS,
OF BEST CAST STEEL.
*HARDENED GROUND & BURNISHED.*
3-16" to 3" Diameter.
Samples and Prices on application.
**SIMONDS ROLLING-MACHINE CO.**
FITCHBURG, MASS.

## WELDLESS STEEL QUICK OPENING GATE VALVE COLD DRAWN TUBES
SMOOTH INSIDE & OUT.
JOHN S. LENG, 4 Fletcher St N.Y.

## J. E. LONERGAN & CO.
211 Race St., Phila.
Manufacturers of



**PATENT OILERS,**
Cylinder Sight Feed Cups, Government Regulation Pop Safety Valves, for Locomotive, Stationary and Marine Boilers, also the "Reliable" Steam Trap.




ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills, and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

## S. ASHTON HAND MFG. CO.,
*Toughkenamon, Chester Co., Pa.*
MAKERS OF FIRST-CLASS
## ENGINE LATHES
Are now in position to put on the market,
*14" ENGINE LATHES OF NEW DESIGN,*
guaranteed to be equal in material, design and workmanship to the best ever offered.

FOR
SUBSTANTIAL, WELL MADE, LOW PRICED
## 20 INCH DRILLS,
With latest improvements, Lever or Wheel feed, address
*Sibley & Ware,*
SOUTH BEND - - INDIANA.

## UPRIGHT DRILLS

A SPECIALTY.
ALL SIZES
—WITH—
Patent Quick Return
—AND—
Latest Improvements.
For Catalogues and Prices, address,
**BICKFORD DRILL CO.**
Cor. Front & Pike Sts.
CINCINNATI, O.

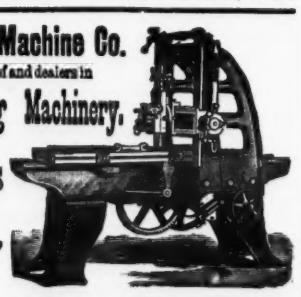
## DIXON'S INDIA SILVER LEAD
*Joseph Dixon Crucible Co.*
JERSEY CITY, N. J.

—OUR— NEW CATALOGUE OF TOOLS
and Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).
CHAS. A. STRELINGER & CO., Wood Ave., Detroit, Mich.

## EMERY WHEEL TOOL GRINDER.
55 STYLES AND SIZES — Guaranteed Satisfactory.
WRITE FOR Illustrated Circular, No. D.
Patented Sept. 25, 1883.

SPRINGFIELD GLUE & EMERY Wheel Co. Springfield, MASS.
Water Prevents HEATING THE WORK

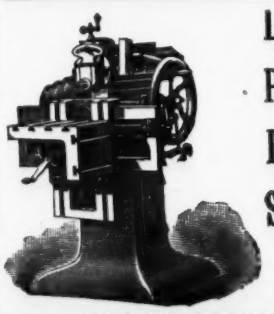
## L. W. Pond Machine Co.
Manufacturers of and dealers in
**Iron Working Machinery.**
IMPROVED IRON PLANERS
A Specialty.
140 Union St., WORCESTER, MASS.



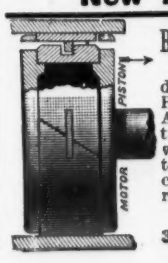
NEW YORK AGENTS.
FRASER & ARCHER,
NEW AND SECOND-HAND MACHINERY,
SHAFTING, HANGERS AND PULLEYS,
*121 CHAMBERS STREET.*

Do You Use Glue?
Improved Steam Glue Heaters
without joints, and therefore free from leakage. Furnished with plain iron, Enameled iron or Copper Pots. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper, and send for Price List to makers. Made in nineteen different styles.
PANCOAST & MAULE,
245 South Third Street,
PHILADA. PA.
BUILD THESE

## "Twenty Years with the Indicator."
2 vols., $3.00. By THOS. PRAY, JR., C. & C. E. and C. & M. E. Six thousand sold. J. Wiley's Sons, 15 Astor Place, N. Y., or Thos. Pray, Jr., P. O. Box 2728, Boston, Mass.

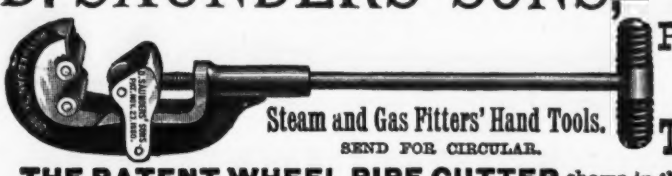


## LATHES, PLANERS, DRILLS, SLOTTERS, Etc.
**NEW HAVEN MANUFAC'G CO.,**
New Haven, Conn.



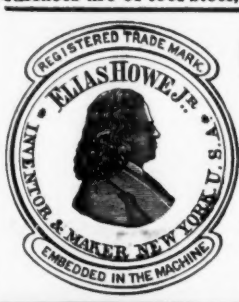

## Brandon's Piston Ring Packing
Perfectly balanced against undue pressure in all directions. Preserves both cylinder and rings. Allows no waste by either friction or leakage. Call and see working model, expressly made to demonstrate advantages claimed. For packing or shop rights, address
JAMES BRANDON,
390 Eleventh Ave., New York.

# D. SAUNDERS' SONS, Yonkers, N.Y.
MANUFACTURERS OF



Pipe Cutting, THREADING, AND Tapping Machines.
Steam and Gas Fitters' Hand Tools.
SEND FOR CIRCULAR.

**THE PATENT WHEEL PIPE CUTTER** shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel, hardened. Less friction of parts than any other pipe-cutter made.




THE
## New Howe Mfg. Co.
BRIDGEPORT, CONN.
*Mfrs. of Sewing Machines*
Light and Medium Weight
**Gray Iron Castings**
OF ALL DESCRIPTIONS TO ORDER; ALSO,
TOOL MAKING, JAPANNING —AND— PLATING.
*Correspondence Solicited.*

## UPRIGHT POWER HAMMER.

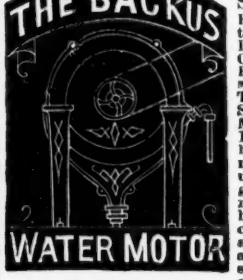
This Hammer possesses advantages superior to any other in the market. It has neither cylinders, valves or piston rods, consequently repairs are trifling. It takes up less space, less power to drive; strikes much harder and truer blows than hammers with double the weight of ram.

It can be worked to strike good alternate blows on a 3-inch and ¾-inch bar when a 100-pound hammer is used, and can be used on die work to a far greater advantage than any other hammer known. Manufactured by the

B. A. BELDEN CO., Danbury, Conn.

## SHAPING MACHINES
FOR HAND AND POWER.
6", 8" and 10" Stroke.
Adapted to All Classes of Work to their Capacity.
*Circulars Furnished.*
**BOYNTON & PLUMMER,**
WORCESTER, MASS.

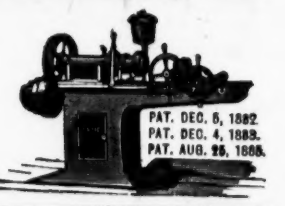
## THE BACKUS WATER MOTOR



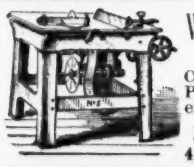
SUPPLIES FROM HYDRANT PRESSURE the cheapest power known. Invaluable for blowing Church Organs, running Printing Presses, Sewing Machines in Households, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Electric Lights, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engineer, explosion, or delay, no extra insurance, no coal bills. Is noiseless, neat, compact, steady; will work at any pressure of water above 15 lb.; at 40 lb. pressure has 4-horse power, and capacity up to 10-horse power. Prices from $15 to $300. Send for circular to
THE BACKUS WATER MOTOR CO., Newark, N. J.

## THOS. H. DALLETT & CO.
13th & Buttonwood Sts., PHILA. PA
Manufacturers of
**PATENT Portable Drilling Machines,**
VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.
SEND for ILLUSTRATED CATALOGUE.

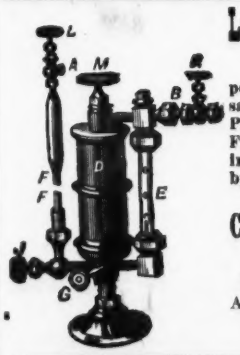
## ACME MACHINERY CO.,
CLEVELAND, OHIO.
Manufacturers of
"ACME"
Single & Double Automatic Boltcutters,
cutting from 3-8 in. to 6 in. diameter,
Also SEPARATE HEADS AND DIES.
Send for Catalogue and Discounts.
*Agents*, Manning, Maxwell & Moore, New York.




## MACHINERY
For Reducing and Pointing Wire.
**Especially Adapted to pointing wire rods and wire for drawing.**
For Machines or information, address the manufacturer.
**S. W. GOODYEAR, Waterbury, Ct.**



## Wood-Working Machinery
For Chair, Furniture and Cabinet Factories, Box Shops, Planing Mills, Pattern Makers' use, etc.
ROLLSTONE MACHINE CO.
45 Water St., Fitchburg, Mass.




## Lubricate Your Engine CYLINDERS
perfectly, gain power and save oil by using our Patent Automatic Sight Feed Lubricators, showing oil as it enters, drop by drop.
THE SEIBERT
**Cylinder Oil Cup Co.**
BOSTON, MASS.
H. A. ROGERS,
Agent for New York,
19 John Street,
NEW YORK.

## P. BLAISDELL & CO.
Manufacturers of
**Machinists' Tools,**
WORCESTER, MASS.

## VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

## FORBES & CURTIS,
BRIDGEPORT, CT.,
Manufacturers of
**The Forbes Pat. Die Stocks,**
Power Pipe Cutting and Threading Machines, Cutting-off Machines, Ratchet Drills, Special Machinery, etc., etc.
WRITE FOR CATALOGUE.
Mention Paper.

## THE MASON REDUCING VALVE
GIVES SATISFACTION WHEREVER USED
OFFICE 22 CENTRAL ST. BOSTON. MASS.

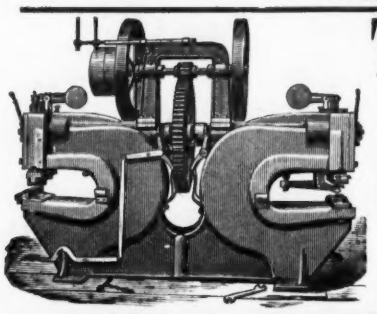
JENKINS BROS. AGENTS, New York & Chicago.

## HIGH SPEED POWER TRAVELING CRANES.

We are now prepared to build HIGH SPEED POWER TRAVELING CRANES for any capacity of load, any length of runway and any width of span, with one or with two trolleys on the bridge. These trolleys to work either slow or fast, together or independently, in like or in opposite directions, horizontally or vertically, while the bridge can be traversing slow or fast at the same time in either direction. The speeds of bridge on runway are *100 feet and 200 feet per minute;* the speeds of trolleys on bridge are *50 feet and 100 feet per minute;* and there are four hoisting speeds *of 5, 10, 20 and 40 feet per minute;* all can be varied quickly without the least shock or jar from zero to maximum or to any intermediate speed. *The load is always automatically sustained, thus avoiding absolutely the great danger and anxiety which are inseparable from the use of those Cranes which require the operator to apply the brake.* We have had one of these Cranes of 26 tons capacity in constant use in our foundry for nearly two years, and we offer them with full confidence for the greatest range of service. We invite the correspondence of parties interested in the subject.

**WM. SELLERS & CO., Incorporated,**
**PHILADELPHIA, PA.**

---

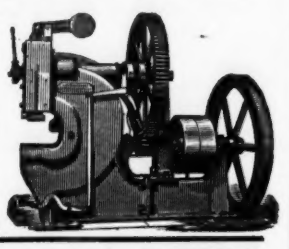


## THE LONG & ALLSTATTER CO. Hamilton, OHIO.

Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

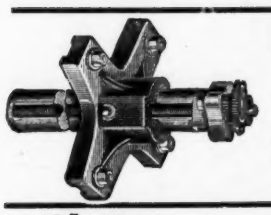
**Punches and Shears.**

Over 300 Sizes.
ALSO,
Power Cushioned Hammer.



Send for new Catalogue.

---



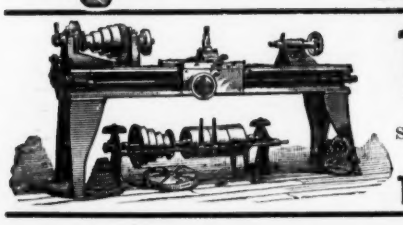
## BORING BAR FOR LATHE.

**BUILT ANY SIZE REQUIRED.**

Has Hardened Steel Centers, Constant Feed of Cut Gears, Steel Feed Screw and Nut, Accurately Ground, First-class Lathe Tool.

**PEDRICK & AYER,**
**PHILADELPHIA, PA.**

---



## 16" Engine Lathes

NEW DESIGNS—LATEST IMPROVEMENTS—SIMPLICITY OF CONSTRUCTION—WORKMANSHIP OF THE BEST.
Send for Cuts and Prices.

**The Muller Machine Tool Co.** Eighth & Evans Sts., CINCINNATI, O.

---

## REMOVED

*On or about June 1st*

**H. BICKFORD,**

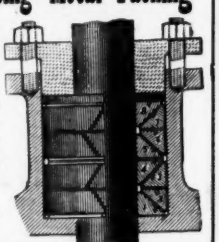
*will remove his business to*

**LAKE VILLAGE, N. H.,**

*into new shops fitted up with new and latest improved tools, especially adapted for manufacturing Boring and Turning Mills which will be made an exclusive specialty, 4-5-6 and 8 ft. Swing.*

---

## Katzenstein's Self-Acting Metal Packing



For Piston Rods, Valve Stems, etc., of Steam Engines, Pumps, etc., adopted and in use by leading engine builders, mills, iron works and steamship companies all over the world. Also flexible tubular metal packing for slip joints on steam pipes, and for hydraulic pressure.

**L. Katzenstein & Co.,**
357 WEST STREET, N. Y.

---

## FLUOR SPAR The Best *Foundry* FLUX.

SEND FOR LIST OF USERS.

**Evansville Spar Mining Co.,** Evansville, Ind.

---

**WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.**

THE BEST
Non-Conducting Covering for Steam Pipe and Boilers.

The only genuine Fossil Meal. Sold in bags of 110 lbs. each. Beware of imitations. Send for circulars.

Trade-mark. W. B. C.

**Fossil Meal Co.,** 48 Cedar St., N. Y.
A. GIESE, Sole Proprietor.

---

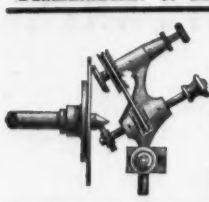
## MACHINERY, TOOLS and SUPPLIES.

Complete Outfits for
MACHINISTS, BLACKSMITHS, MODEL MAKERS, JEWELERS, ETC.
**Lathes, Planers, Shapers, Drill Presses, Emery Grinders, Milling Machines, Bolts, Screws, Washers, Belting, Packing, Waste, Twist Drills, Taps, Reamers, Cold Rolled Shafting, Hangers, Files.**

SEND FOR ILLUSTRATED PRICE LIST OF METAL-WORKERS' TOOLS, ALSO WOOD-WORKERS'.

**TALLMAN & McFADDEN, 1025 MARKET STREET, PHILADELPHIA**

---



**Friction Driven Center Grinder.**

A neat, simple and cheap tool to true up centers, will grind centers up quicker than they can be annealed, turned and hardened, will go on any size lathe without any adjustment.

Send for descriptive circular
**ENERGY M'F'G CO.**
1115 to 1123 S. 15th Street,
PHILADELPHIA, PA.

---

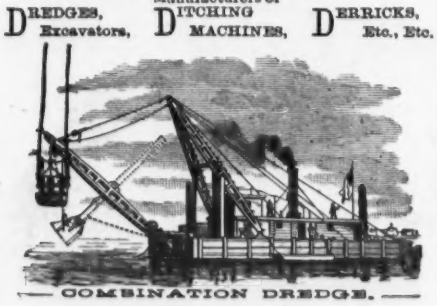
## WORCESTER MACHINE SCREW CO.

**Manufacturers of Set, Cap and Machine Screws. Studs, etc.**

---

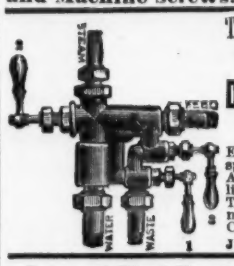
**OSGOOD DREDGE CO., - ALBANY, N. Y.**
RALPH R. OSGOOD, Pres. JAMES H BLESSING, Vice-Pres.
JOHN K. HOWE, Secretary and Treasurer.

Manufacturers of
DREDGES, Excavators, DITCHING MACHINES, DERRICKS, Etc., Etc.



COMBINATION DREDGE.

---




The BEST in the World.
Sustained by the U. S. Courts.
—The—
**Duplex, Union and Alert**
**INJECTORS.**

Simple in construction. Easily taken apart. No springs to get out of order. Always ready. Always delivers water hot to boiler. Thousands in use and demand increasing. Send for Catalogue, to

JAS. JENKS & CO., Detroit, Mich

---

Iron and Wood Turning Lathes and Lathe Heads, Emery Grinders, Gear Cutting attachments for Lathes, special Screws, Studs, etc.

**PROGRESS ENGINE & MACHINE WORKS,**
**SUMMERFIELD, MD.**

---

## BEMENT, MILES & CO.,

**PHILADELPHIA, PA.**

—BUILDERS OF—

## METAL-WORKING MACHINE TOOLS

FOR

**Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works,**

**ETC. ETC.**

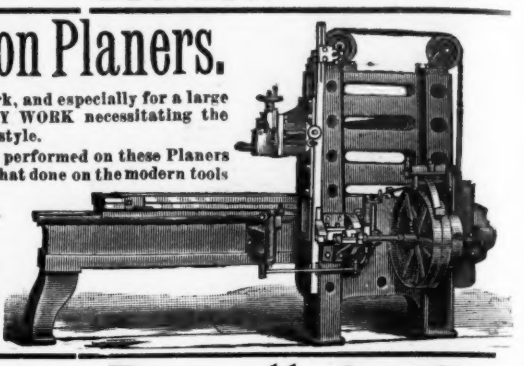
---

## The Open Side Iron Planers.

Adapted for all classes of Machine Work, and especially for a large amount of the EXTRA WIDE and HEAVY WORK necessitating the Large and Costly Planers of the regular style.

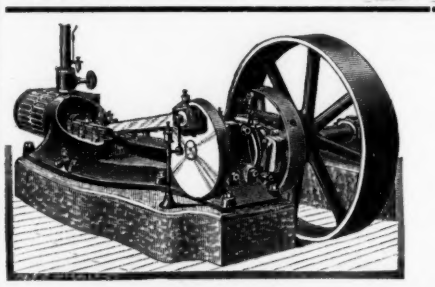
The QUALITY and QUANTITY of work performed on these Planers is GUARANTEED to be UNEXCELLED by that done on the modern tools of the very best makes.

Prices, phototypes and detailed information on application.



**DETRICK & HARVEY,**
**BALTIMORE, MD.**

---



## Russell & Co.

**MASSILLON, OHIO,**

BUILDERS OF

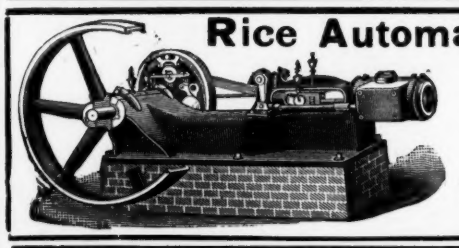
**AUTOMATIC ENGINES**

**BOILERS, ETC.**

Complete Power Plants Furnished and Erected.

SEND FOR CATALOGUE.

---



## Rice Automatic Cut-off Engine

**Self-Contained. Sensitive Governor. Balanced Valve. High Speeds. Stationary Oilers. Best Economy.**

*Gold Medal Cincinnati Exposition,* 1884.

**THE JOHN T. NOYE MFG. CO.,**
**BUFFALO, N. Y.**

---

## STEEL CASTINGS

**From 1-4 TO 15,000 lbs. WEIGHT.**

True to Pattern, sound, solid, free from blow-holes and of unequaled strength.

Stronger and more durable than iron forgings in any position or for any service whatever.

40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this.

Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.

STEEL CASTINGS of every description.

Send for Circulars and Prices to

**CHESTER STEEL CASTINGS CO.,**
Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.

---

## THE SKINNER ENGINE CO.

**ERIE, PA.**

PORTABLE AND STATIONARY
**ENGINES and BOILERS**
Send for Catalogue and Prices.

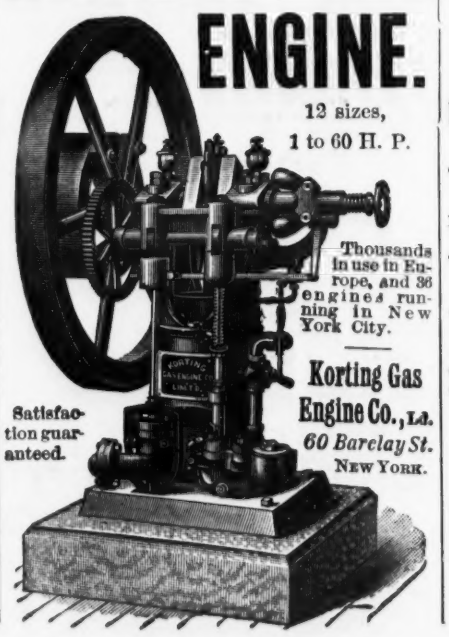
---

PATENT UNIVERSAL SCREW-CUTTING CENTER DEPTH ANGLE AND
**J. WYKE & CO., TWIST DRILL GAUGE.**
Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular

---

## KORTING GAS ENGINE.

12 sizes,
1 to 60 H. P.



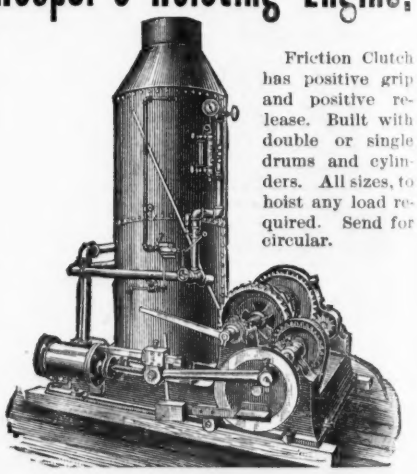
Thousands in use in Europe, and 36 engines running in New York City.

Satisfaction guaranteed.

**Korting Gas Engine Co., Ld.**
*60 Barclay St.*
NEW YORK.

---

## Hooper's Hoisting Engine.



Friction Clutch has positive grip and positive release. Built with double or single drums and cylinders. All sizes, to hoist any load required. Send for circular.

BUILT BY **ALEXANDER TRAUD,**
**East Ferry Street Iron Works**
**NEWARK, N. J.**

---

**E. P. B. SOUTHWORTH,**
94 Exchange street, Rochester, New York.
Indicating Engineer and Mechanical Draftsman.
Correspondence solicited.

---

## BARGAIN LIST,

| | | | | |
|---|---|---|---|---|
| One Gray & Wood's Planer 22" wide 14' long, | | | | Second Hand. |
| " | Plain Milling Machine | | | " " |
| " | Hand Planer 18"x18"x24" | | | " " |
| Two | 70 H.P. Stationary Boilers | | | " " |
| One | 60 " | " | " | " " |
| " | 20 " | Coil | " | " " |
| " | 20 " | Stationary Engine | | " " |
| " | 15 " | Vertical | " | " " |
| " | 12 " | " | " | " " |
| " | 10 " | " | " | " " |
| " | 12 " | " | " | New. |
| " | 35 " | Center Crank | " | " |
| " | 25 " | " " | " | " |
| " | 15 " | " " | " | " |

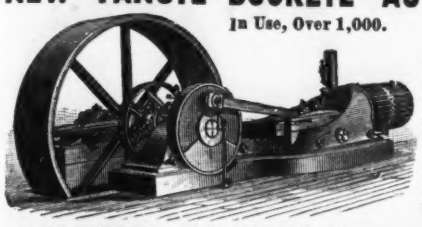
" Portable Saw Mill with Saw, Belts and Fixtures complete.

**S. L. HOLT & CO.**
67 SUDBURY ST., Boston, Mass.

## NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000.

25 to 1,000 H. P.



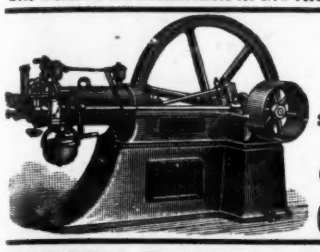
These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H.P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. Address, BUCKEYE ENGINE CO., Salem, Ohio.

SALES AGENTS: W. L. SIMPSON, 301 TELEPHONE BUILDING, 18 CORTLANDT STREET, N. Y. {N. W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. {ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

## "OTTO" GAS ENGINE WORKS.



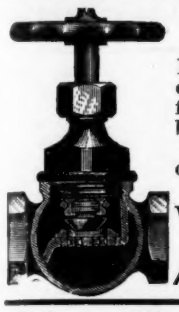
SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts. PHILADELPHIA. Branch Office, 130 Washington St. CHICAGO.

OVER 20,000 ENGINES IN USE.

GUARANTEED To Consume 25 to 75 Per Cent. Less Gas than ANY Other Gas Engine doing the same work.

## BLESSING'S RENEWABLE-SEAT GLOBE, STRAIGHTWAY and CHECK VALVES.

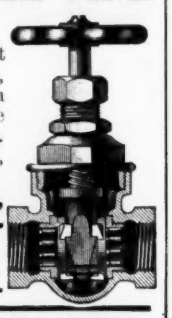


The renewable Seats and Disks are cast from the best Phosphor Bronze Metal, which has lasting qualities, double that of the best Steam Metal commonly used in first-class valves. The Seats are simply screwed to place by the use of a special wrench furnished with each valve.

These valves are equally applicable to steam, water, or other fluid pressure.

We also manufacture **Blessing's Albany Steam Traps, Water Circulator and Purifier; and Pump Governor.**

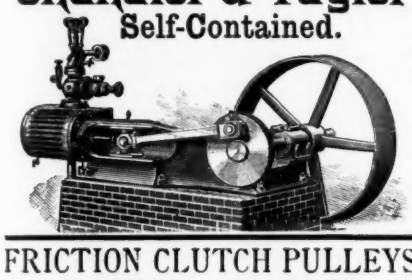
SEND FOR CIRCULAR.



ALBANY STEAM TRAP CO., Albany, N.Y.

## Chandler & Taylor's STEAM ENGINES

Self-Contained.



Are Strong, Well-Built and Serviceable.
Are designed for Heavy and Continuous Work.
May be run at High Speed when desired, performing the duties of High Grade Engines,
And are sold at the prices of ordinary Engines.

For Prices and Descriptive Circulars, address

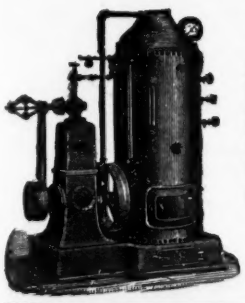
CHANDLER & TAYLOR,
INDIANAPOLIS, IND.

## FRICTION CLUTCH PULLEYS,

*HOISTING ENGINES,*
*ELEVATORS.*
*STEAM AND BELT POWER.*

D. FRISBIE & CO., 112 Liberty St., N. Y.

## The Castle Engine.



A NEW MECHANICAL MOVEMENT.

Only eight moving pieces. No packing required. Takes up its own lost motion. Noiseless and self-lubricating. Large wearing surfaces. More economical after long usage than a slide valve engine when new. High-test Steel Boilers.

Size: 1 to 10 H. Power.

Send for Circular No. 5.

Castle Engine Works, Indianapolis, Ind.

## MACHINE TOOLS.

NEW AND SECOND-HAND, ON HAND.

| | | | |
|---|---|---|---|
| 12 in. x 6 ft. | Engine Lathe, | | new. |
| 13 in. x 6 ft. | " | Ames, | " |
| 14 in. x 6 ft. | " | Blaisdell, | " |
| 16 in. x 6-8-10 & 12 ft. | " | Bridgeport, | new. |
| 16 in. x 6 | " | Blaisdell, | " |
| 18 in. x 8 ft. | " | Blaisdell, | " |
| 19 in. x 13 & 14 ft. | " | Pond, | nearly new. |
| 20 in. x 10 ft. | " | Lathe and Morse, | fair. |
| 20 in. x 10 & 12 ft. | " | Ames, | new. |
| 24 in. x 10-14 & 20 ft. | " | Ames, | " |
| 23 in. x 8-12 & 14 1-2 ft. | " | Bridgeport, | " |
| 24 in. x 16 ft. | " | New Haven, | good order. |
| 26 in. x 16 ft. | " | New Haven, | good as new. |
| 30 in. x 14 ft. | " | W. and L. pattern, | new. |
| 42 in. x 16 ft. | " | Ames, | " |
| 50 in. x 24 1-2 ft. | " | New Haven, | A 1. |
| 54 in. x 30 ft. | " | Niles, | good as new. |
| 16 in. x 42 in. | Planer | Bridgeport, | new. |
| 16 in. x 3 ft. | " | Pratt & Whitney, | good order. |
| 22 in. x 4 ft. | " | Pease, | new. |
| 22 in. x 4-5& 6 ft. | " | Powell, | " |
| 22 in. x 5 ft. | " | Hendey, | new. |
| 24 in. x 6 ft. | " | Hendey, | " |
| 24 in. x 6 ft. | " | Wood and Light, | good. |
| 26 in. x 5 ft. | " | Biglow, | " |
| 26 in. x 7 ft. | " | Brettell, | new. |
| 30 in. x 7 ft. | " | New Haven, | fair. |
| 30 in. x 8 ft. | " | Hewes & Phillips, | new. |
| 30 in. x 10 ft. | " | Hendey, | " |
| 36 in. x 12 ft. | " | Niles Tool Works, | A 1. |
| 12 in. Shaper, | | Traveling Head, | new. |
| 12 in. | " | Hewes & Phillips, | " |
| 13 in. Stroke, 9 ft. Bed, Trav. Head Shaper, | | Barr, | A 1. |
| 24 in. Shaper, | | Bridgeport, | new. |
| 24 in. | " | Wolcott, | " |
| 16-18-20-23-25-28-34 in. Drills. | | 30 in. Radial Drill. | |
| 13 in. Stroke Slotter | | H. & P. | new. |
| 16 in. | " | Miles, Phila., | A 1. |
| Center Bolt Cutter, | | | new. |
| 50 in. Boring and Turning Mill. | | | A 1. |
| 5 in. Cutting Off Machine Star. | | | |
| Fitchburg Car Axle Lathe. | | | |
| Merrill Drops, 800 lbs. | | | good order. |
| Bement 2250 lb. Steam Hammer. | | | |

Milling Machines, Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools. Send for list and specify what is wanted.

E. P. BULLARD,
72 Warren Street and 62 College Place, New York.

## PORTER-HAMILTON ENGINE.

FOR HEAVY WORK AND LARGE POWERS.
EXTRA HEAVY DESIGN.
Send for Catalogue.

WILLIAM TOD & CO.,
YOUNGSTOWN, OHIO.

## To Buyers of Engine Lathes

**We are now making from entirely new designs, *extra heavy* 19" and 21" Engine Lathes (the most popular sizes), of which we are making a specialty, and manufacturing in lots of not less than 100 at a time.**

**We make no charge for extras. Every lathe is furnished with *hollow spindle*; the 19" with 1⅝" hole, and 21' with 1⅞" hole. Every lathe has substantial *compound rest*, heavy tool post (bar steel), rest to turn full swing, *following rest* with adjustable jaws to take any size from 2½" down, with extra tool for shafting. Full set of gears to cut from 2 to 18 threads including 11½ pipe thread. *Automatic stop on carriage. Separate screw and rod feed*, and the most substantial and easily managed *taper attachment* made. Cones and gears of large diameter and wide belt. Studs, screws and small gears are *steel or gunmetal*. Webbed live heads, heavy tail stocks. No worm or worm gears, no weak reverse plate. *Perfect lubrication for all running parts*, including carriage.**

**Lead screw inside of shear, double nut (cut from solid), and taking hold of carriage directly under the line of strain. Friction counter-shaft, the most durable made. Our prices are reasonable for cash, and from which no deviation will be made. Our written guarantee accompanies every lathe.**

### GUARANTEE.

**We guarantee this lathe to be equal in workmanship, truth, accuracy, solidity, material and finish, to the best made, and hold ourselves legally liable for this guarantee.**

## LODGE, DAVIS & CO.

MANUFACTURERS

Machine Tools,

159, 161, 163 and 165 EGGLESTON AVE.,
136, 138, 146, 148, 150, 152, 154 E. 6th St.

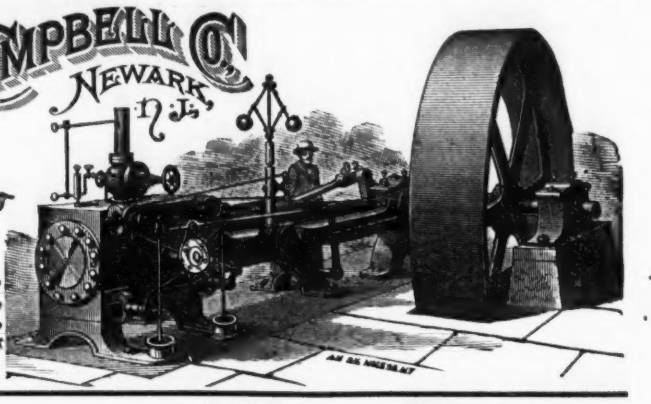
CINCINNATI, OHIO.

(See our advertisement on last page.)

## The Watts, Campbell Co.

NEWARK, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.



Sizes Varying From 30 to 2000 Horse Power.

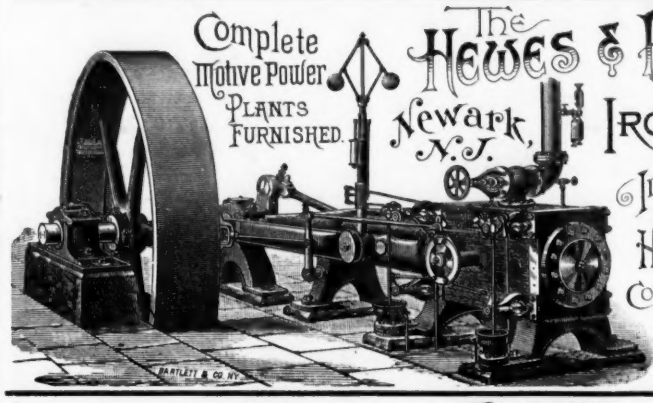
Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.

Send for Circular.

## The Hewes & Phillips Iron Works

Newark, N.J.

Complete Motive Power Plants Furnished.



Improved CORLISS ENGINES, High Pressure. Condensing and Compound TUBULAR BOILERS.

GEO. A. BARNARD, AGENT.

## THE IMPROVED FISHKILL CORLISS ENGINE

BUILT BY THE FISHKILL LANDING MACHINE CO.,

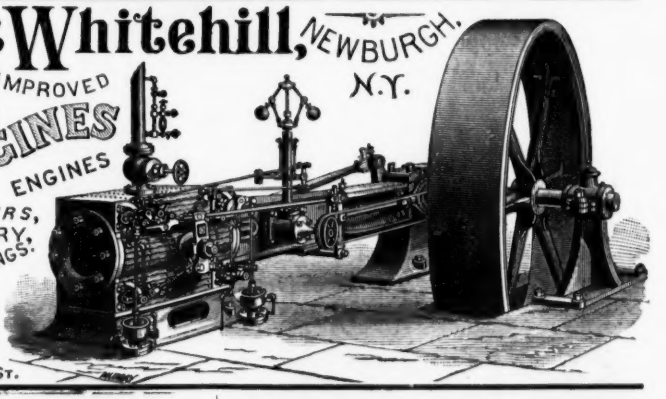
FISHKILL ON THE HUDSON, N.Y.

## Robert Whitehill, NEWBURGH, N.Y.

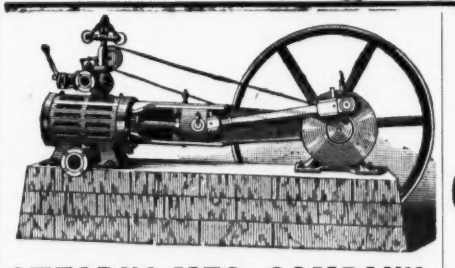
MANUFACTURER OF IMPROVED CORLISS ENGINES

ALSO SLIDE VALVE ENGINES

STATIONARY BOILERS, GENERAL MACHINERY, IRON AND BRASS CASTINGS.



NEW YORK OFFICE Room 6, COAL AND IRON EXCHANGE, COR. CORTLANDT & CHURCH ST.



## STEARNS MFG. COMPANY,

ERIE, PA.

Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

Having enlarged our Foundry and otherwise added to our facilities, we are prepared to execute orders for castings weighing from a few pounds to *forty tons*. Our Boring and Turning Mill is one of the largest in the United States, by which we can bore and turn a wheeel or cylinder up to 30 feet in diameter, and we can plane 30 feet long by almost any width. With our *unsurpassed* means for handling heavy work, and shipping *by boat or rail*, we are enabled to

OFFER INDUCEMENTS

to customers.

We make a specialty of machinery for making Sugar, and furnish everything necessary to fully equip Sugar Refineries or Plantations. Satisfaction guaranteed, and patronage solicited.

S. S. HEPWORTH & CO.,
"Glenwood Station," Yonkers, N. Y.

## JOHN McLAREN,

HOBOKEN, N. J.

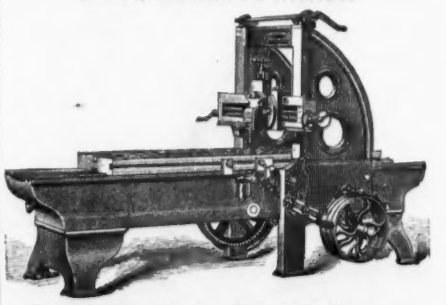
BUILDER OF

CORLISS ENGINES,

AIR COMPRESSORS AND BOILERS.

## FLATHER PLANERS

Sizes, 22 and 26 inches.



Ready for immediate delivery.

26 in. x 26 in. x 6 ft.
26 in. x 26 in. x 8 ft.

## HILL, CLARKE & CO.

36 Oliver St., Boston.

JANUARY 1, 1887.

# REVISED CATALOGUES & PRICE-LISTS

OF ABOVE DATE

Now Ready and Sent by Mail on Application.

# BROWN & SHARPE MFG. CO.,

MANUFACTURERS OF

Castings, Machinery & Tools.

# DARLING, BROWN & SHARPE,

MANUFACTURERS OF

U. S. Standard Rules, Cast Steel Try Squares,
Standard Wire Gauges, and Tools for Accurate Measurements.

**PROVIDENCE, R. I., U. S. A.**

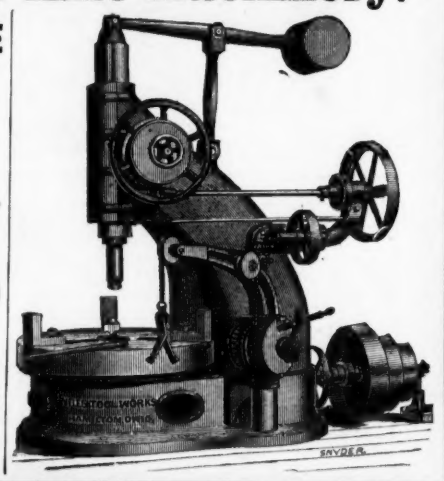
---

## Car Wheel and Axle Machinery.

RAILROAD, LOCOMOTIVE AND CAR SHOP

EQUIPMENTS

Photographs and Prices on Application.



# NILES TOOL WORKS,

Hamilton, Ohio.

NEW YORK, 96 Liberty St.
PHILADELPHIA, 705 Arch St.
CHICAGO, 96 Lake St.

---

# CRANES OF ALL TYPES AND CAPACITY

FOR HAND OR POWER.

*SWING, PILLAR, LOCOMOTIVE, DERRICK, JIB, WALKING, TRAVELING, TRAM.*

PARTICULARS ON APPLICATION.

THE YALE & TOWNE MFG. COMPANY,

STAMFORD, CONN.

NEW YORK–CHICAGO–PHILADELPHIA–BOSTON.

---

# ENGINE LATHES, SHAPERS & DRILLS.

20 in. Upright Drill.
24 " " "
26 " Back Geared
30 " and
38 " Power Feed Drills.

LODGE, DAVIS & CO.

CINCINNATI, OHIO.

Send For Prices. It Will Pay You.

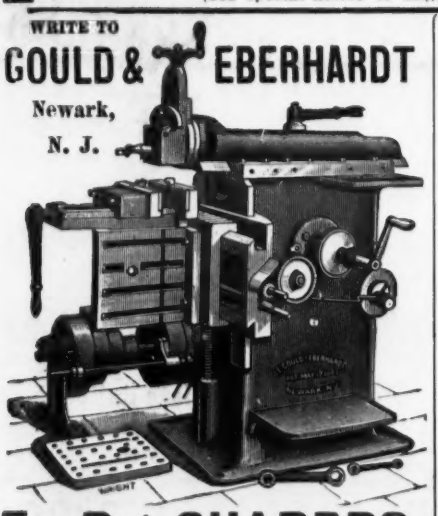
(See special notice of Engine Lathes on page 15.)

---

WRITE TO

# GOULD & EBERHARDT

Newark, N. J.



For Pat. SHAPERS.

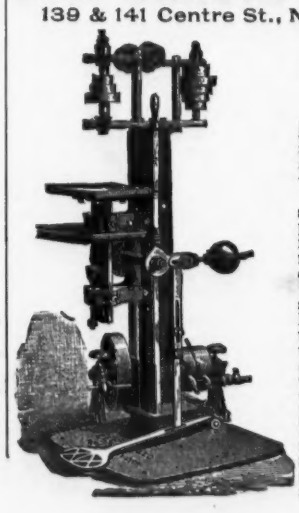
Sizes 10", 15", 20", 25", 30" in stock.

OVER 1,000 IN USE.

---

# E. E. GARVIN & CO.,

139 & 141 Centre St., New York,



Manufacturers of

Machinists' Tools,

Including Milling Machines, Drill Presses, Hand Lathes, &c.

The machine shown in cut, is especially designed for jobbing, and is fitted up with one or two spindles. Those with two spindles have pulley, with two sections, which gives two speeds to each spindle. Those fitted up with one spindle have a cone pulley with three sizes. The back shaft has a cone pulley with four sizes.

---

# THE PRATT & WHITNEY CO.

HARTFORD, CONN.

Manufacture and have ready for delivery, TURRET HEAD MACHINES of 10, 12, 14, and 16 in. swing, with or without cut-off rest, suitable for finishing brass and other metals that do not require a free use of oil in cutting them. Prices are less than for screw machines, and will be given on application. The CUSHMAN PATENT COMBINATION LATHE CHUCKS are made stronger than formerly, have jaws ground true, and are offered at 25 per cent. discount from list.

---

# THE BILLINGS & SPENCER COMPANY,

HARTFORD, CONN.,

MANUFACTURERS OF

## Billings' Improved Combination Pliers,

Drop Forged from Tool Steel.

**DROP FORGINGS** in Copper, Iron or Steel, for Electric Motors and Generators, Guns, Pistols, Sewing Machines,

MACHINISTS' TOOLS AND

Machinery Generally.

Send for Illustrated Catalogue.

---

# WARNER & SWASEY,

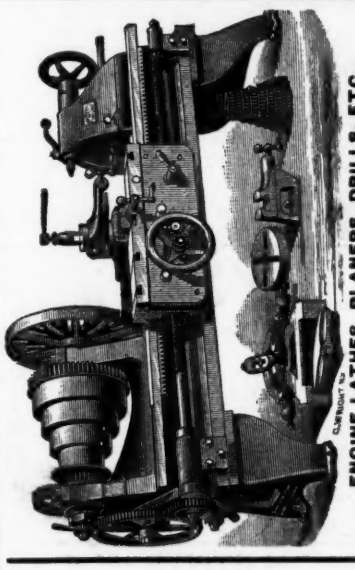
CLEVELAND, OHIO.

Machine Tools FOR

IRON & BRASS WORK.

Send for Illustrated Catalogue.

---



ENGINE LATHES, PLANERS, DRILLS, ETC.

POND MACHINE TOOL CO., Successors to DAVID W. POND

New Designs, Quick Delivery, Great Variety. Worcester, Mass.

Manning, Maxwell & Moore, Sole Selling Agts, 111 Liberty St., New York.

---

# GEO. W. FIFIELD,

MANUFACTURER OF

# ENGINE LATHES

FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

---

J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

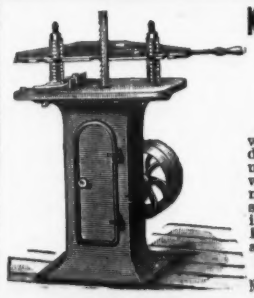
---

**BRASS GEARS.** I keep in stock a large variety of Cut Gears of Brass and send them post-paid at very low prices.

SEND FOR MY CATALOGUE.

*Geo. B. Grant, 66 Beverly St., Boston, Mass.*

---



# KEY-SEATING MACHINES,

and 20-in. Drills,

A SPECIALTY.

Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment both Key-Seating Machines and 20-in. Drills. Send for Photo. and Catalogue.

W. P. DAVIS,

NORTH BLOOMFIELD, N. Y.

---

For Prices and Photographs Write

# THE G. A. GRAY CO.,

Sycamore & Webster St., Cincinnati, O.

Lathes, 17 in. 20 in.

Planers, 26 in. x 24 in. 32 in. x 30 in. 38 in. x 36 in.

---

# STEEL CASTINGS.

PRATT & LETCHWORTH, PROPRIETORS

Buffalo Steel Foundry, BUFFALO, N. Y.

---

# PUNCHING PRESSES, DIES,

And other Tools for the Manufacture of all kinds of

SHEET METAL GOODS, DROP FORGINGS, —ETC.— DROP HAMMERS.

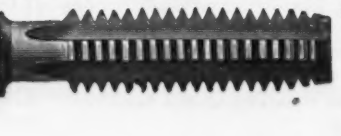
STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Office and Factory 203, 205, and 207 CENTRE STREET, NEW YORK.

---

J.M. CARPENTER
PAWTUCKET, R.I.



Manufacturer of TAPS & DIES